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NUCLEAR SCIENCE ABSTRACTS

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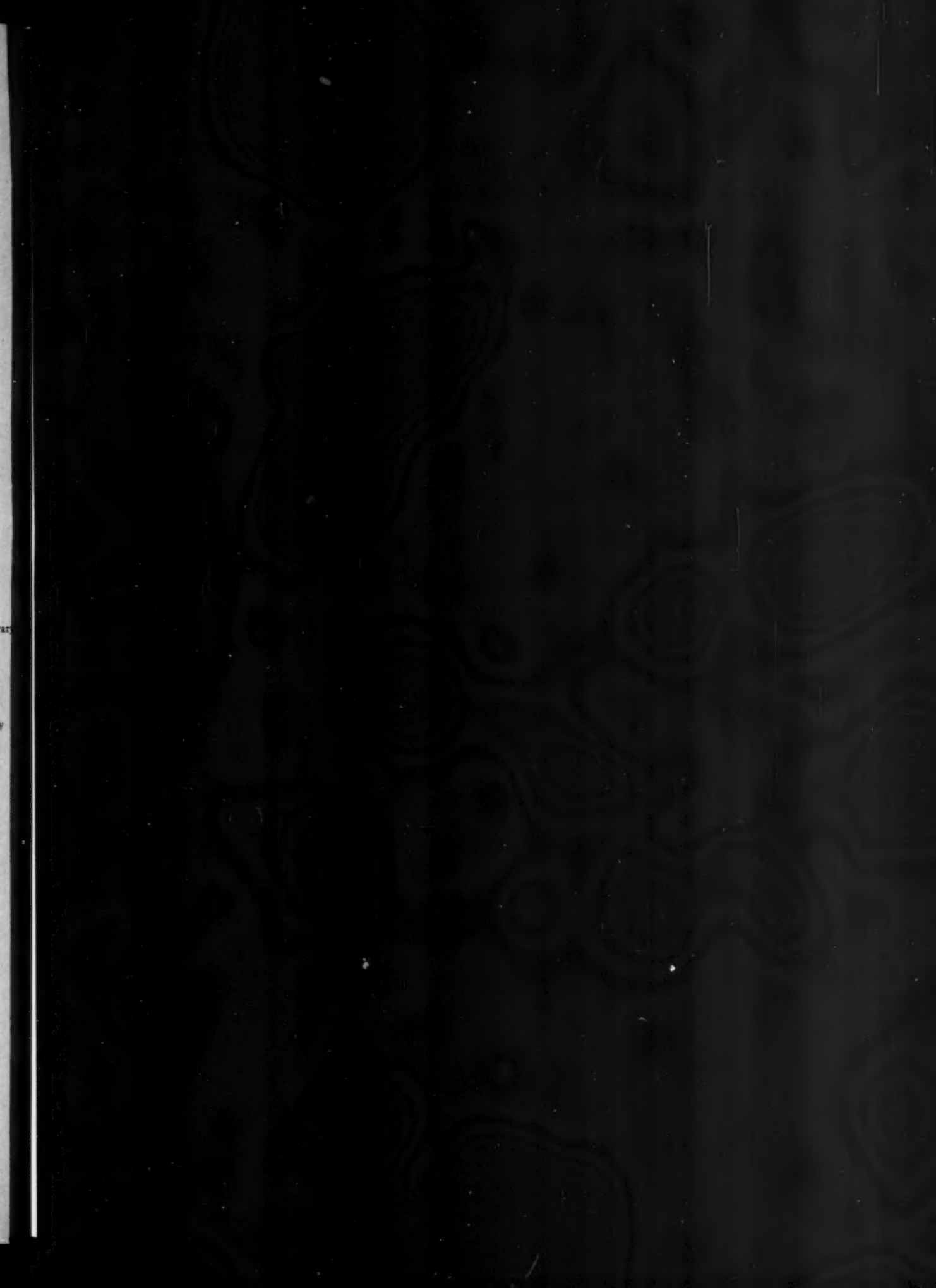

NUCLEAR SCIENCE ABSTRACTS

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 2 January 31, 1958

GENERAL

Atomic Bombs and Warfare

Refer also to abstracts 1349 and 1350.

1147 USNRDL-TR-170

Naval Radiological Defense Lab., San Francisco.

PHYSICAL, CHEMICAL, AND RADIOLOGICAL PROPERTIES OF SLURRY PARTICULATE FALLOUT COLLECTED DURING OPERATION REDWING. N. H. Farlow and W. R. Schell. May 5, 1957. 19p. Project Ns 088-001.

The properties of individual fallout particles produced by nuclear detonations at zero height over shallow sea water are analytically described. The particles produced during Operation REDWING were slurry masses composed of water, dissolved and crystalline sea salts, and sea water-insoluble solids from the weapon, barge, and ocean floor. Special techniques were used to measure the chloride, water, and insoluble-solids content of individual slurry particles. Autoradiography showed that the activity is primarily associated with the solids. A table of experimental data presents particle size versus time of arrival after detonation as well as measurements of particle density and relative specific activity. Estimates of mass and relative activity of fallout per unit area for certain locations about the shot point are shown. (auth)

1148 WT-1179

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

BIOLOGICAL EFFECTS OF PRESSURE PHENOMENA OCCURRING INSIDE PROTECTIVE SHELTERS FOLLOWING A NUCLEAR DETONATION. C. S. White, T. L. Chiffelle, D. R. Richmond, W. H. Lockyear, I. G. Bowen, V. C. Goldizen, H. W. Merideth, D. E. Kilgore, B. B. Longwell, J. T. Parker, F. Sherping, and M. E. Cribb. Oct. 1956. 216p. Project 33.1 [of] OPERATION TEAPOT. $5.50(OTS).

In two series of experiments 277 experimental animals, including 66 dogs, 52 rabbits, 52 guinea pigs, 63 rats, and 44 mice, were exposed under selected conditions in six different general types of instrumented above- and below-ground shelters to blast produced by nuclear explosions. The distance of the several structures from Ground Zero ranged from 1050 to 5500 ft. The most severe alterations in the pressure environment occurring inside the structures followed the detonation of a nuclear device with a yield approximately 50% greater than nominal. The highest overpressure to which animals were exposed was 85.8 psi, the rise time of which was 4 msec. The overpressure endured for about 570 msec. Overpressures ranged from this maximum downward in 15 other exposure situations to a minimum of 1.3 psi enduring for nearly 1346 msec but rising to a maximum in about 420 msec. The latter pressure occurred inside a reinforced concrete bathroom shelter, which was the only surviving part of a house otherwise totally destroyed, at 4700 ft where the outside incident pressure was about 5 psi. Following the nuclear explosions, all animals were recovered, examined, sacrificed, and subjected to gross and microscopic pathological study. All lesions were tabulated and described. The results of pressure-time data, documenting the variations on the pressure environment, are presented and analyzed, and an exploratory attempt is made to relate the alterations in the pressure environment to the associated pathology observed. A critical review of selected material from the blast and related literature is presented. All data are discussed, and the several problems related to the design and construction of protective shelters are noted and briefly, but analytically, assessed. The most outstanding contribution of the field experiments and the related study of the literature was the unequivocal demonstration that the provision of adequate protective structures can indeed be an effective means of sharply reducing casualties which would otherwise be associated with the detonation of modern large-scale explosive devices. (auth)

Atomic Power

1149

ATOMIC ENERGY APPLICATIONS WITH REFERENCE TO UNDERDEVELOPED COUNTRIES. B. C. Netschert and S. H. Schurr. Baltimore, The Johns Hopkins Press, 1957. 143p. $2.00.

Potential applications of atomic energy in the world economy are surveyed. It is suggested that studies should be made to determine how each country could best benefit from the multipurpose use of atomic energy and how the use of atomic energy would affect the country's development plans and prospects. Technical assistance and personnel training programs now in effect are discussed. (C.H.)

1150

ATOMIC ENERGY FACTS. A SUMMARY OF ATOMIC ACTIVITIES OF INTEREST TO INDUSTRY. NUCLEAR TECHNOLOGY SERIES. Washington, U. S. Atomic Energy Commission, 1957. 226p. Available from U. S. Government Printing Office for $2.00.

Information is given to serve as an introduction to nuclear operations in the U. S. and as a handbook of related information for the use of industrial firms and others actively interested in atomic energy. This compilation of previously published material is intended primarily for general readers rather than for specialists. Topics of interest to industrial management are covered. The technical information services available from the AEC are described and directions for their use are given. The conditions under which qualified individuals and organizations can gain access to classified information are given. Discussion of special materials, patents, and licenses that can be obtained from the Commission is included. The Commission's programs for training and education in nuclear science and technology are reported. Industrial participation in atomic energy work of friendly nations is covered. The organization and functions of the AEC are described and the activities of its major contractors are sketched. The Atomic Energy Commission's raw and feed materials, reactor, and radioisotope programs relating to peaceful uses of atomic energy are summarized. Programs connected with weapons

and support of basic research in universities are not included. (M.H.R.)

1151

REPORTS ON THE PRODUCTIVE USES OF NUCLEAR ENERGY. NUCLEAR POWER AND ECONOMIC DEVELOPMENT IN BRAZIL. Stefan H. Robock. Washington, National Planning Association, 1957. 136p. $2.75.

The prospect for productive uses of nuclear power is studied in Brazil as an example of an economically underdeveloped, but rapidly industrializing country. A situation is analyzed where, in the short run, an adequate supply of electricity is more important than its cost and where foreign exchange and capital availability are the primary factors influencing the availability of power. In another 15 to 20 years, the more economical hydro sites will probably be fully developed and competitive nuclear power might contribute to Brazil's economic growth over the longer term, due to flexibility of plant location and lower capital investment. Results of the survey of economic factors and natural resources involved in future power for Brazil are given. (M.H.R.)

1152

NUCLEAR FISSION ENERGY PRODUCTION AND CHEMISTRY. COMMUNICATION NO. 1. H. de Bruijn, J. P. W. Houtman, M. Bustraan, W. E. van Rijswijk de Jong, M. E. A. Hermans, T. J. Barendregt, C. Bokhoven, J. Spaepen, J. Kooi, and Th. van der Plas. 's Gravenhage, Reactor Centrum Nederland, 1957. 354p. (In Dutch)

The ten papers presented deal with several phases of energy production by nuclear fission. The economic aspects of power reactors, the Calder Hall Central Station, physical principles of research reactors, nuclear fuel production from raw materials, fuel elements, heavy water production, radiation effects on solids, reprocessing of nuclear fuels, and fission products are discussed. (T.R.H.)

BIOLOGY AND MEDICINE

1153 WADC-TR-55-16(Vol. II)

National Research Council. Div. of Biology and Agriculture.

HANDBOOK OF TOXICOLOGY. VOLUME II. ANTIBIOTICS. William S. Spector, ed. — John N. Porter and Gilbert C. De Mello, comps. June 1957. 276p. Project No. 7159. Contract AF33(616)-2873. (AD-130959).

This report presents data on the physical, chemical, biological and toxicological properties of 340 antibiotics, compiled from more than 2500 literature references. The material is as up-to-date as possible at the time of publication. To enhance reliability, and consequently usefulness, each page of data has been exhaustively reviewed and authenticated by the contributors. The compilation is unusually complete, not only with respect to the selection of antibiotic compounds, but also with the coverage of each. Wherever possible, data are presented on the source, nature, structure and formula, physical and chemical properties, biological activity (both in vivo and in vitro), toxicity, and utilization for each compound. A huge bibliography at the back of the book is divided into sets of references and literature citations, with one set for each antibiotic, in the same sequence as the compounds appear in the volume. Two appendices supplement the text, One is an antibiotic efficacy listing by organism, and the other is a compendium of antibiotic-source microorganisms. The book also contains a cross index of synonyms, proprietary names, and official designations for the compounds involved. An informative introduction explains some of the problems encountered in compiling data on the biological and toxicological properties of antibiotics and the reasons for wide variations in such data even within a single species. The introduction points out that although the information given in this volume is as authentic and reliable as could be procured, the book is still, nevertheless, a survey, and the values presented herein should be considered as "yardsticks" of activity rather than as absolute and definitive. The compilers recognize that all data, and particularly those in the fields of toxicology and antibiotics, are subject to continuing revision as investigators standardize techniques and make more measurements. (auth)

1154 AEC-tr-3042

ECOLOGY OF LAND ANIMALS. E. THE ECOLOGICAL SYSTEM. W. Tischler. Translated from Handbuch der Biologie, 101-11([1955?]). 23p.

1155

THE LUMINESCENCE OF CHLOROPHYLL-CONTAINING PLANT MATERIAL. Gordon Tollin and Melvin Calvin (Univ. of California, Berkeley). Proc. Natl. Acad. Sci. U. S. 43, 895-908(1957) Oct.

The luminescence of various chlorophyll-containing plant materials has been investigated under a variety of conditions. The results have been shown to be consistent with a mechanism involving the recombination of electrons and holes trapped in a quasi-crystalline lattice. Some details of such a mechanism have been proposed which suggest the mode of entry of the light energy into the photosynthetic pathway. (auth)

1156

TEMPERATURE TOLERANCE OF EGGS AND YOUNG OF COLUMBIAN RIVER CHINOOK SALMON. P. A. Olson and R. F. Foster (General Electric Co., Richland, Wash.). Trans. Am. Fisheries Soc. 85, 203-7(1955).

1157

NEUTRON ACTIVATION ANALYSIS FOR MEDICAL ISOTOPE DOSIMETRY WITH SPECIAL CONSIDERATION OF COLLOIDAL Au^{198}. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/205. J. H. Muller. London, Pergamon Press, Ltd., 1957. 11p.

Radiation Effects

1158 UCRL-3735

California. Univ., Berkeley. Radiation Lab.

SOME EFFECTS OF RADIATIONS ON CELL PROLIFERATION. Cornelius A. Tobias. Aug. 19, 1957. 11p. Contract W-7405-eng-48. $0.50(OTS).

Some of the factors controlling tissue growth in animals and cell proliferation in unicellular organisms are reviewed. Radiation damage in diploid yeast cells manifests itself sometimes in delayed lethal effect and decreased cell division rate over several generations in the progeny of the irradiated cell. Recovery of the progeny of irradiated yeast cells from phenotypic expression of radiation damage can be delayed over many generations and is similar, in time rate of onset to the onset of radiation-induced animal tumors. A parallel suggests itself between the mechanism of somatic-radiation carcinogenesis and delayed recovery of unicellular organisms from radiation effect. (auth)

1159 UR-506

Rochester, N. Y. Univ. Atomic Energy Project.

THE EFFECT OF IONIZING IRRADIATION ON LONGEVITY. John B. Hursh. Aug. 22, 1957. 29p. Contract W-7405-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Among the important late effects of ionizing radiation is the shortening of average length of life. Experiments on rats and mice have shown that for single sub-lethal doses of x-rays, this life shortening is 25 to 50% per 1000 roentgens, the proportional amount of shortenings increasing with dose size. For chronic irradiation an estimate is made of approximately 10% per 1000 r. Generalizations which summarize this experimental information are reviewed. Finally the possible significance of this effect for maximum permissible exposure levels is discussed. (auth)

1160 USNRDL-TR-173

Naval Radiological Defense Lab., San Francisco.
TIME OF APPEARANCE OF SKIN LESIONS FOLLOWING EXPOSURE TO BETA RADIATION. A. K. Davis and E. L. Alpen. June 21, 1957. 19p. Project NM-006-015.

Measurements of the response of rat, guinea pig, dog, and pig skin to beta radiation have been made at doses of 450 to 100,000 rad. The results indicate that above the threshold for wet desquamation the sequence of events is an early erythema; a latent period of five to seven days during which the skin appears normal; and a short period of dry desquamation, lasting only one or two days, followed by necrosis and sloughing of the skin in the irradiated area. The wet ulcer is then covered by a dry crust which persists until healing is complete. A dose of 15,000 rad produced edema of the irradiated site by the first day in all rats and occasional edema in guinea pigs and dogs. Higher doses reduced the latent time before ulceration and increased the intensity of the erythema. At 100,000 rad immediate effects of the irradiation causes an intense erythema and accelerates the course of injury described for the doses above 15,000 rad. (auth)

1161 USNRDL-TR-179

Naval Radiological Defense Lab., San Francisco.
EFFECT OF PARTIAL SHIELDING OF RAT INTESTINE DURING X IRRADIATION ON CIRCULATING BLOOD VOLUME. M. N. Swift and S. T. Taketa. Aug. 9, 1957. 20p. Project NM 006-015.

1162 AEC-tr-3077

DYNAMICS OF THE DEVELOPMENT OF BONE SARCOMAS ORIGINATING UNDER THE INFLUENCE OF RADIOACTIVE SUBSTANCE. N. N. Litvinov. Translated by Zelda D. Knowles from Voprosy Onkologii 3, 285-94 (1956). 20p.

1163

THE INFLUENCE OF WHOLE BODY X-IRRADIATION OF THE BIOSYNTHESIS OF CHOLESTEROL IN LIVER. H. K. Hanel, G. Hjort, G. Johansen, and P. R. Purser (Radium Centre Copenhagen, Denmark). Acta Chem. Scand. 11, 1093-4(1957).

1164

LEUKOCYTIC RESPONSE IN LAMBS EXPOSED TO WHOLE-BODY X IRRADIATION. L. A. George, Jr., Patricia L. Hackett, and L. K. Bustad (General Electric Co., Richland, Wash.). Am. J. Vet. Research 18, No. 68, 631-3(1957) July.

1165

ELECTRIC BIREFRINGENCE STUDIES OF IRRADIATED DEOXYRIBONUCLEIC ACID. Amos Norman and John A. Field, Jr. (Univ. of California, Los Angeles). Arch. Biochem. Biophys. 71, 170-8(1957) Sept.

1166

RADIOSENSITIVITY OF MOUSE SPLEEN AND KIDNEY TO CHRONIC ALPHA IRRADIATION. Leiv Kreyberg and Finn Devik (Univ. of Oslo, Norway). Brit. J. Radiol. 30, 477-80 (1957) Sept.

1167

EFFECTS OF X RADIATION ON THE DISTRIBUTION OF DYESTUFFS INTRAVENOUSLY INTRODUCED INTO TISSUES OF MICE. E. Ya. Graevskiĭ and L. I. Korchak (Severtsov Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 115, 702-5(1957) Aug. 1. (In Russian)

1168

EFFECTS OF X RADIATION ON THE MUTABILITY OF ACTINOMYCES SUBTROPICUS (The producer of albomycine). S. I. Alikhanyan and F. S. Klepikova (All-Union Research Inst. of Antibiotics). Doklady Akad. Nauk S.S.S.R. 115, 806-8(1957) Aug. 1. (In Russian)

1169

INFLUENCE OF POST IRRADIATION ADMINISTRATION OF METHIONINE ON THE EXCRETION OF CREATINE, CREATININE AND N-METHYL NICOTINAMIDE IN URINE OF RATS. U. S. Kumta, S. U. Gurnani, and M. B. Sanasrabudhe (Atomic Energy Establishment, Bombay). Experientia 13, 372-3(1957).

1170

INDUCED CHANGES IN FEMALE GERM CELLS OF DROSOPHILA. II. OVIPOSITION RATE AND EGG MORTALITY IN RELATION TO INTENSITY AND DOSAGE OF X-RAYS APPLIED TO OOCYTES. S. Abrahamson and Irwin H. Herskowitz (Indiana Univ., Bloomington). Genetics 42, 405-20(1957) July.

1171

INDUCED CHANGES IN FEMALE GERM CELLS OF DROSOPHILA. IV. DEPENDENCE OF INDUCED CROSS-OVER-LIKE EXCHANGES IN OOCYTES AND OOGONIA UPON X-RAY INTENSITY. Irwin H. Herskowitz and S. Abrahamson (Indiana Univ., Bloomington). Genetics 42, 444-53(1957) July.

1172

THE POSSIBILITY OF FORECASTING THE RELATIVE RATE OF INDUCED LOSS FOR ENDOSPERM MARKERS IN MAIZE. A. C. Fabergé (Oak Ridge National Lab., Tenn.). Genetics 42, 454-72(1957) July.

1173

STUDIES OF FACTORS CAUSING THE DISTURBANCE OF THE ESTRUAL CYCLE IN MICE FOLLOWING WHOLE-BODY EXPOSURE TO X RADIATION. N. I. Shapiro, N. I. Nuzhdin, and O. N. Kitaeva (Inst. of Genetics, Acad. of Sciences, U.S.S.R.). Izvest Akad. Nauk S.S.S.R. Ser. Biolog. 537-55(1957) Sept.-Oct. (In Russian)

1174

EFFECT OF EXPOSURE TO GAMMA-RAYS ON THE HYGROSCOPICITY OF SITKA SPRUCE WOOD. J. M. Paton and R. F. S. Hearmon (Forest Products Research Lab., Princes Risborough, Aylesbury, Bucks). Nature 180, 651(1957) Sept. 28.

1175

THE EFFECT OF X-RAYS ON DIFFERENT QUALITIES ON THE ALKALINE PHOSPHATASE OF LIVING MOUSE BONE. II. EFFECTS OF 22.5-Mev γ-RAYS. H. Q. Woodard and J. S. Laughlin (Sloan-Kettering Inst., New York). Radiation Research 7, 236-52(1957) Sept.

1176

AN ANALYSIS OF THE ROLE OF DOSE AND DOSAGE RATE IN THE EARLY RADIATION MORTALITY OF THE CHICK. S. P. Stearner and S. A. Tyler (Argonne National Lab., Lemont, Ill.). Radiation Research 7, 253-66(1957) Sept.

1177

THE EFFECT OF X-IRRADIATION ON THE ABSORPTION OF PLUTONIUM IN THE GASTROINTESTINAL TRACT.

Harry Foreman, James Post, and Camille Finnegan (Los Alamos Scientific Lab., N. Mex.). Radiation Research 7, 267-9(1957) Sept.

1178

BACTERIOLOGICAL STUDIES ON MICE EXPOSED TO SUPRALETHAL DOSES OF IONIZING RADIATIONS. I. RADIATION FROM A NUCLEAR DEVICE. Myron S. Silverman, Victor P. Bond, Vivian Greenman, and Paul H. Chin (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Radiation Research 7, 270-6(1957) Sept.

1179

THE EFFECT OF TOTAL-BODY X-IRRADIATION ON THE CIRCULATION OF SPLENECTOMIZED DOGS. Shu Chien, Larissa Lukin, A. Phyllis Holt, Sheldon H. Cherry, Walter S. Root, and Magnus I. Gregersen (Columbia Univ., New York). Radiation Research 7, 277-87(1957) Sept.

1180

THE COMBINED EFFECTS OF IONIZING RADIATION AND LOW TEMPERATURE ON THE METABOLISM, LONGEVITY, AND SOFT TISSUES OF THE WHITE RAT. II. HISTOLOGIC CHANGES. P. C. Griffith, W. J. Scheyer, and S. W. Lippincott (Univ. of Washington School of Medicine, Seattle). Radiation Research 7, 288-97(1957) Sept.

1181

THE DEPENDENCE OF THE ACTIVITY OF SECRETIONS ON THE CONCENTRATION OF RADIOACTIVE MATTER WITHIN AN ORGANISM. Yu. M. Shtukkenberg. Soviet J. Atomic Energy No. 5, 801-9(1956).

Detailed calculations of the dependence of the activity of excretion on the amount of radioactive matter contained within an organism are given, when the excretion of this matter follows the exponential law. (auth)

1182

CHRONIC TOTAL BODY IRRADIATION OF WHITE MICE AT A SMALL DOSE RATE. Mario Dorneich and Boris Rajewsky. Strahlentherapie 103, 327-31(1957). (In German)

1183

ELECTROPHORETIC INVESTIGATION OF THE BLOOD SERUM OF IRRADIATED AND HIBERNATING DORMICE. Gerhard Schubert, Hans A. Künkel, and Heinrich Maab. Strahlentherapie 103, 368-75(1957). (In German)

1184

INVESTIGATION OF THE BIOLOGICAL DOSE EQUIVALENCE BETWEEN HARD X-RAYS OF 180 Kv AND THE ELECTRONS OF Sr^{90} ON MONOCELLULAR OVA OF ASCARIS MEGALOCEPHALA. Richard Kurt Kepp and Günter Oehlert. Strahlentherapie 103, 392-7(1957). (In German)

Radiation Hazards and Protection

1185 AECU-3547

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

EFFICIENCY OF SCAVENGING DEVICES IN DETERMINING FALLOUT. Progress Report No. 6 [for] March 15 to July 31, 1957. John Rosinski. Sept. 23, 1957. 40p. ARF Project C 082. Contract AT(11-1)-375. $6.30(ph OTS); $3.00(mf OTS).

A fall-out sample collector was designed and tested for use in collecting samples at the soil surface. The sampler consists of artificial grass and a stainless steel pot. Results are included from preliminary studies on the scavenging properties of artificial grass. The effects of relative humidity, rain, and wind velocity on the efficiency of scavenging devices were investigated. A comparison was made of Sr^{90} fall-out data from samples collected on gummed film and surface soil samples from various locations. Preliminary experiments were performed for the evaluation of devices used in determining air concentration of radioactive fall-out or other particulate matter. (For preceding period see AECU-3435.) (C.H.)

1186 ANL-5755

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT FOR JANUARY THROUGH JUNE 1957. July 1957. 86p. Contract W-31-109-eng-38. $2.25(OTS).

Progress is reported in the following studies: the autoradiographic mapping of the deposition of Ca^{45} in cortical bone in dogs; measurement of fission-product activity present in soil; factors affecting the performance of ionization chambers; calibration tests on the dibutyl phosphate method of isolating Th^{228} from solutions of ashed bone; microradiographic demonstration of changes in mineral density in dog bones; radiometric determination of radon in bone and in the atmosphere; changes produced in xylene by exposure to massive doses of Co^{60} γ radiation; applications of the human spectrometer in in vivo measurements of Cs^{137} build-up in humans; determinations of Cs^{137} atmospheric content as a function of time; development of a tracer method using K^{42} for measurement of exchangeable potassium in humans; determinations of the radium body burdens in former dial painters; and the atmospheric diffusion of stack particles. A meteorological model towing tank is described which was constructed as an alternative to a wind tunnel for model studies of atmospheric turbulent diffusion. Preliminary studies employing the apparatus are described. (For preceding period see ANL-5679.) (C.H.)

1187 NP-6459

Gt. Brit. Home Office. Scottish Home Dept., Edinburgh.

ASSESSMENT OF THE PROTECTION AFFORDED BY BUILDINGS AGAINST GAMMA RADIATION FROM FALLOUT. 1957. 18p.

A method is described for estimating the protection against γ radiation from radioactive fall-out afforded by buildings. A sample calculation is included. (C.H.)

1188 ORNL-2410

Oak Ridge National Lab., Tenn.

THE SUSPENDED MICROBIOTA OF THE CLINCH RIVER AND ADJACENT WATERS, IN RELATION TO RADIOACTIVITY IN THE SUMMER OF 1956. J. B. Lackey. Nov. 13, 1957. 36p. Contract W-7405-eng-26. $1.25 (OTS).

The Clinch River enters the Oak Ridge area virtually free of plankton. It is fertilized in this area and develops a considerable plankton by the time it enters Watts Bar Lake. This plankton may acquire considerable amounts of radioactivity from the very small amounts contributed by the Oak Ridge operations. Some figures are presented showing the radioactivity accumulated by various species, and the rate of accumulation as compared to reproductive rates. Diminution of radioactivity in both plankton and water is traced downstream. Conditions in the Clinch and Columbia Rivers are compared. The principal source of radioactive wastes for the Clinch River insofar as known is the effluent from the ORNL settling basin, which empties via White Oak Creek. Along with this small quantity of radioactive waste the river receives some nutrient materials and a mixed population of microorganisms. A small amount of radioactive seepage from the ORNL disposal pits may enter the creek. The Clinch and neighboring waters yielded 425 species of algal or protozoan microorganisms, which are listed in an appendix, in the summer of 1956. (auth)

1189 USNRDL-TR-183
Naval Radiological Defense Lab., San Francisco.
EFFECT OF BONE MARROW-SPLEEN INJECTION AFTER FAST NEUTRON IRRADIATION IN MICE. L. J. Cole and M. E. Ellis. Sept. 25, 1957. 29p. Project NM-006-015.

1190
THE EFFECT OF SOMATOTROPIC HORMONE AND OXYTETRACYCLINE ON WEIGHT AND MORTALITY OF IRRADIATED RATS. J. M. Bloodworth, Jr., Joseph L. Morton, Donald Shoffstall, and George J. Hamwi (Ohio State Univ. Coll. of Medicine, Columbus). Cancer 10, 884-8(1957) Sept.-Oct.

1191
ON THE METABOLISM OF CAESIUM, STRONTIUM AND A MIXTURE OF β-EMITTERS IN COWS. D. I. Ilin and Yu. I. Moskalev. J. Nuclear Energy 5, 413-20(1957).

1192
INTRAVENOUS INFUSION OF BONE MARROW IN PATIENTS RECEIVING RADIATION AND CHEMOTHERAPY. E. Donnall Thomas, Harry L. Lochte, Jr., Wan Ching Lu, and Joseph W. Ferrebee (Mary Imogene Bassett Hospital, Cooperstown, N. Y.; Children's Medical Center, Boston, Mass.; and Harvard Medical School, Boston, Mass.). New Engl. J. Med. 257, 491-6(1957) Sept. 12.

Observations from a year's experience in collecting, storing and using human bone marrow are recounted. The effects, in a small series of patients, of intravenous infusion of cellular suspensions of marrow are reviewed. Marrow may be obtained from fetal and adult cadavers and from biopsy and surgical specimens, preserved in glycerol at −80°C and administered, intravenously, to patients with safety. The indications, contraindications and general potential field of usefulness of marrow transplantations are discussed. (auth)

1193
MODIFICATION OF RADIATION-INDUCED INJURY BY POST TREATMENT WITH OXYGEN. Richard S. Caldecott, Elizabeth Bindloss Johnson, D. T. North, and C. F. Konzak (Univ. of Minnesota, Minneapolis and Brookhaven National Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 975-83 (1957) Nov.

Radiation Sickness

1194
THE CONDITION OF NERVE ELEMENTS IN LYMPHOID TISSUE DURING ACUTE RADIATION SICKNESS. I. B. Soldatov (Kirov Military−Military Academy). Doklady Akad. Nauk S.S.S.R. 115, 803-4(1957) Aug. 1. (In Russian)

Radiotherapy

1195
THE USE OF I^{133} IN THE TREATMENT OF GRAVES' DISEASE. Mones Berman, David V. Becker, and Richard S. Benua (Sloan-Kettering Inst. for Cancer Research, New York Hospital-Cornell Medical Center, and Department of Medicine Memorial Center, New York). J. Clin. Endocrinol. Metabolism 17, 1222-8(1957) Oct.

1196
RADIATION TREATMENT OF LARGE SKIN AREAS WITH RADIOPHOSPHORUS LACQUER. Eberhard Günsel and Karl-Heinz Liedtke. Strahlentherapie 103, 511-17(1957). (In German)

Toxicology Studies

1197
ABSENCE OF LETHAL RADIATION EFFECTS FOLLOWING MASSIVE ORAL ADMINISTRATION OF PLUTONIUM. Maurice F. Sullivan and Roy C. Thompson (General Electric Co., Richland, Wash.). Nature 180, 651-2(1957) Sept. 28.

1198
DATA ON TOXICOLOGY OF RADIOACTIVE MATERIALS. I. CESIUM, STRONTIUM, RUTHENIUM, AND RADON. Institute of Sanitation and Occupational Disease, Academy of Medical Sciences, U.S.S.R. 1957. (In Russian)

A series of articles are presented on the subject of absorption, distribution, and excretion of radioactive materials of Sr, Cs, Ru, and Rn. The radiotoxic effects of Ru, Ce, Sr, and Rn under acute and chronic conditions are analyzed, and the experiments in stimulating the excretion of Sr and Ce from the organism are discussed. (R.V.J.)

Tracer Applications

1199 UR-507
Rochester, N. Y. Univ. Atomic Energy Project.
METABOLISM OF INDIUM. II. THE DISTRIBUTION AND EXCRETION OF $INDIUM^{114m}$ ADMINISTERED TO THE RAT BY SUBCUTANEOUS INJECTION. Geneva A. Smith and James K. Scott. Aug. 15, 1957. 21p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

1200 USNRDL-TR-175
Naval Radiological Defense Lab., San Francisco.
STUDIES ON THE METABOLISM OF INHALED AEROSOLS OF STRONTIUM AND LANTHANUM. S. H. Cohn, W. B. Lane, J. K. Gong, L. Weisbecker, and W. L. Milne. May 27, 1957. 30p. Project NM-006-015.

The kinetics of the uptake, distribution, and retention in mice of two simulated fission product aerosols, $Sr^{85}Cl_2$ and $La^{140}Cl_3$ were studied. It was found that the gastrointestinal tract, as well as the alveolar tissue, can serve as an important portal of entry into the body for soluble fission product aerosols following inhalation exposure. (C.H.)

1201 AEC-tr-3076
EXPERIMENTAL DETERMINATION OF URANIUM IN LIVING FRESH-WATER ALGAE. (Experimentelle Erfassung von Uran in Lebenden Süsswasseralgen). Josef Hoffmann. Translated by W. H. Everhardy from Naturwissenschaften 29, 403-4(1941). 6p.

1202
SOME FACTORS INFLUENCING THE EXCRETORY PATTERN OF CESIUM-134 IN RATS. Frank R. Mraz and Homer Patrick (Univ. of Tennessee, Knoxville and U. S. Atomic Energy Commission, Oak Ridge, Tenn.). Arch. Biochem. Biophys. 71, 121-5(1957) Sept.

1203
REMOVAL OF INTERNALLY DEPOSITED RADIOCERIUM BY THE USE OF CHELATING AGENTS. A. Catsch and Du Khuong Lê (Heiligenberg Inst., Baden). Nature 180, 609(1957) Sept. 21.

1204
EXCRETION OF YTTRIUM AND LANTHANUM CHELATES OF CYCLOHEXANE 1,2-TRANS DIAMINE TETRAACETIC ACID AND DIETHYLENETRIAMINE PENTAACETIC ACID IN MAN. Harry Kroll, Samuel Korman, Elsie Siegel, Hiram E. Hart, Betty Rosoff, Herta Spencer, and Daniel Laszlo (Montefiore Hospital, New York). Nature 180, 919-20(1957) Nov. 2.

1205
EXCHANGE AND CIRCULATION OF LABELLED IONS IN YOUNG INTACT PLANTS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/

RIC/134. R. J. Helder. London, Pergamon Press, Ltd., 1957. 11p.

A continuous recording counter was used to trace the circuit of P in young barley plants. (T.R.H.)

1206

NATURAL AND ARTIFICIALLY (AIR-PLOWING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/188. Arthur D. Hasler. London, Pergamon Press, Ltd., 1957. 16p.

CHEMISTRY

1207 AERE-I/M-40

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF CAESIUM METABORATE. K. D. Kilburn. July 1957. 6p.

Although the large scale preparation of cesium metaborate would most conveniently use an ion exchange resin, the following method was convenient for a small laboratory preparation: cesium nitrate was converted to the bisulfate, and this with barium hydroxide gave cesium hydroxide. Excess barium hydroxide was precipitated by passing carbon dioxide through the slurry. After filtering, the filtrate was analyzed for cesium, the calculated quantity of boric acid was added, and the water was evaporated off to leave an amorphous powder which, on fusing in vacuo, gave the pure anhydrous borate. (auth)

1208 AGC-AE-38

Aerojet General Corp., Azusa, Calif.

REACTION OF ZIRCALOY-2 WITH WATER AND WITH URANYL SULFATE FUEL SOLUTION. Monthly Progress Report No. 3 [for] September 1 through September 30, 1957. Oct. 28, 1957. 4p. For Oak Ridge National Lab. Contract [W-7405-eng-26], subcontract 1089. (AGC-L3501-01-3). $1.80(ph OTS); $1.80(mf OTS).

1209 CF-57-3-36

Metal Hydrides Inc. [Metals Research Lab.], Beverly, Mass.

THE SODIUM HYDROXIDE–SODIUM HYDRIDE SYSTEM. Marvin S. Kerzner, Henry C. Kelly, and Sidney Johnson. Mar. 7, 1957. Decl. Apr. 1957. 7p. For Oak Ridge National Lab. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Portions of the NaOH–NaH phase diagram were studied by means of differential thermal analysis. Under certain conditions NaH will either react with NaOH according to the equation $NaH + NaOH \rightleftharpoons Na_2O + H_2$ or thermally dissociate according to the equation $NaH \rightleftharpoons Na + \frac{1}{2} H_2$. Both of these reactions are suppressed by a high H_2 pressure; and NaH neither reacts nor dissociates to an extent sufficient to affect the results reported. This was evidenced by the fact that changing the H_2 pressure above the system in the range indicated did not change, within the limit of error of the experiments ($\sim \pm 5°$), the temperature at which a phase change was started or completed. Therefore the concentrations of Na and Na_2O present in the samples must have been small in all cases. Under a high H_2 pressure, therefore, the system may be considered as essentially binary, consisting of NaOH and NaH. (auth)

1210 CF-57-10-23

Oak Ridge National Lab., Tenn.

CLAYS AS SUSPENDING AGENTS FOR THORIA SLURRIES. L. M. Doney and E. D. Lynch. Oct. 4, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Montmorillonite and attapulgite, in concentrations of 3% and above, are very effective in the retardation of settling of ThO_2 slurries and in the prevention of hard-caked sediments. The most useful material found was attapulgite sold under the trade name of Zeogel. Concentrations of 3% were very effective and 5% were even more so. Viscosity of the slurry may be prohibitive in concentrations above 3%. The most desirable pH range appears to be from 7.5 to 9.0 both from the standpoint of rate of settling and hardness of sediment formed. In the preparation of slurries containing these materials, it is essential that the suspending agent be mixed in the water using a high shear type mixer. (auth)

1211 GAT-115(Rev. 1)(Vols. 1-3)

Goodyear Atomic Corp., Portsmouth, Ohio.

WORKS LABORATORY PROCEDURES. Jan. 2, 1957. Vol. 1 decl. Oct. 11, 1957. (Vol. 1, 267p.; Vol. 2, 301p.; Vol. 3, 253p.). Contract AT-(33-2)-1. $8.67(OTS) per set.

These three volumes were issued separately, but are cataloged as a unit.

1212 IDO-16399

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

DEBYE CHARACTERISTIC TEMPERATURES TABLE AND BIBLIOGRAPHY. M. W. Holm. Aug. 6, 1957. 28p. Contract AT(10-1)-205. $1.00(OTS).

The Debye temperatures of many of the elements and of a number of compounds are tabulated. References to original articles are given where possible. Also tabulated are values of Q(z), a function used in calculating Debye-Waller temperature correction factors. (auth)

1213 UCRL-3836

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] MARCH, APRIL, AND MAY 1957. June 28, 1957. 64p. Contract W-7405-eng-48. $1.25(OTS).

Progress is reported in studies in bio-organic chemistry, nuclear chemistry, and process chemistry. A method was developed for tracer studies with oxygen, using paper chromatography and proton activation of O^{18} to F^{18}. The procedure was applied in a preliminary study of the path of oxygen in green algae. The construction is reported of a modified design of a C^{14} respiration-pattern analyzer for humans. Data are included from preliminary studies using the apparatus. Progress is reported in studies on the luminescence spectrum of chloroplasts immediately after exposure to a flash of light; the radiation chemistry of benzene; the preparation of dry $KC^{14}N$; the synthesis of labeled morphine; the demonstration of C^{14} respiration pattern abnormalities in diabetic rats; tracer studies on tissue distribution of diisopropylfluorophosphonate in rats; tracer studies on the incorporation of adenine-C^{14} into nucleotides and nucleic acids in rats; the excretion of cyanide-C^{14} in mice; tracer studies on fat metabolism; the effect of γ radiation on photosynthesis and viability of Chlorella; the photosynthesis of lipids and pigments in algae; the radiation chemistry of trichloroethylene; determination of fission yield curves for the deuteron-induced fission of U^{234}, U^{235}, and U^{236}; and determination of cross sections for deuteron (d,γ) reactions in uranium. (For preceding period see UCRL-3710.) (C.H.)

1214 AEC-tr-3067

CONTRIBUTION TO THE STUDY OF REACTION BETWEEN GASES AND SOLIDS. A. Van Tiggelen, L. Van Reusel, and P. Neven. Translated from Bull. soc. chim. Belges 61, 651-82(1952). 27p.

Some heterogeneous reduction reactions between Ag salts and H_2 have been studied. The following salts were studied: silver chloride, cyanide, sulfate, oxide, phosphate, borate, and sulfide. In the case of the chloride in particular, the reaction was inhibited by the resulting HCl_3. An empirical expression which describes the rate of reaction and which completely accounts for the experimental observations is proposed; it can best be explained by assuming a reaction mechanism which has as its essential feature the adsorption of activated H_2. When the gaseous reaction product is eliminated continuously, the reaction becomes strictly first-order with respect to the O_2. The activation energy was determined in each of the reactions studied. Some reactions were also studied which involved the thermal decomposition of the Ag salts: the decomposition of the oxide was studied in the presence of O_2 and Ag, of the cyanide with formation of cyanogen, of the sulfite with formation of the sulfurous anhydride, and of the permanganate with formation of O_2. These reactions undergo auto-acceleration which is relatively slow for the samples studied; consequently it was possible to determine the energy of activation of each of these reactions. (auth)

1215 AEC-tr-3068

NOTES ON SURFACE REACTIONS. G. M. Schwab. Translated from Chimia (Switz.) 9, 250-5(1955). 15p.

1216

NEW METHOD FOR POLAROGRAPHIC STANDARDIZATION. John T. Porter II (Knolls Atomic Power Lab., Schenectady, N. Y.). Anal. Chem. 29, 1638-9(1957) Nov.

A new method for maintaining polarographic standardization is based on correction for changes in capillary characteristics on basis of change in diffusion current of a reference reduction, which need not be carried out in same medium. Limitations imposed by failure of Ilkovič equation are presented. (auth)

1217

SOLVOLYSIS IN HYDROGEN AND DEUTERIUM OXIDE. II. STRONGLY SOLVATED SUBSTRATES. R. E. Robertson and P. M. Laughton (National Research Council and Carleton Univ., Ottawa, Can.). Can. J. Chem. 35, 1319-24 (1957) Nov.

Rates of solvolysis are presented for a number of polar substrates in light and heavy water from which the rate ratios k_{D_2O}/k_{H_2O} may be obtained. Compounds studied include methyl, o-methyl-, p-methyl-, p-methoxy-, and p-fluoro-benzenesulfonate, the α- and β-methylation series of alkyl methanesulfonates, methyl and isopropyl nitrate, methyl phosphate and sulfate, methane- and benzenesulfonyl chloride, and t-butyldimethylsulfonium iodide. The oxyanion esters, despite wide variation in reactivities, show very small variation in the rate ratios which lie near 0.9. The values for the chlorides are 0.63, and for the sulfonium salt, 0.95. The failure of the rate ratios to reflect the mechanistic changes required by variation in the alkyl groups and oxyanions is attributed to the structure of initial state solvation and the easy saturation of ratio-affecting structural changes by small charge development in the transition state. (auth)

1218

SAFE WAY TO DISCONNECT "HOT" HOSE LINES. Herbert P. Cantelow (Univ. of California, Berkeley). Chem. Eng. 64, No. 5, 294(1957) May.

A safe method is presented for disconnecting radioactively contaminated hose lines from hot cells. (W.L.H.)

1219

MEASUREMENTS OF RADIOELEMENT CONCENTRATIONS IN LOCALIZED AREAS OF DILUTE SOLUTIONS. Irene Kadometzeff. J. chim. phys. 54, 501-13(1957) July-Aug. (In French)

A method for the determination of the concentration of gamma emitters in a given section of a solution by counting "useful" photons is given. The definition of "useful" photons and "parasitic" photons is given, and the methods of channeling and analysis which permit the establishment of this distinction are described. Precision, apparatus, and applications of the method are given. (T.R.H.)

1220

PREPARATION OF FEED MATERIALS FOR ELECTROLYTIC PRODUCTION OF THORIUM METAL. Charles E. Fisher and James L. Wyatt (Horizons Inc., Cleveland, Ohio). J. Electrochem. Soc. 104, 672-7(1957) Nov.

A potentially economical method for production of thorium metal is the electrolysis of fused thorium tetrachloride in sodium chloride. Preparation of suitable feed constituents for the electrolyte is described. Thorium nitrate was converted to thorium tetrachloride by aqueous chemical and thermal decomposition techniques; intermediate steps include the formation of an ammonium complex which may be dehydrated. (auth)

1221

INVESTIGATION OF THE MECHANISM OF SULPHUR COMPOUND REACTIONS AND OF SULPHUR ISOTOPE EXCHANGE. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/55. A. E. Brodsky and G. P. Miklukhin. London, Pergamon Press, Ltd., 1957. 14p.

1222

MEASUREMENT OF THE RELATIVE MOBILITY OF CATIONS IN MIXTURES OF OXIDE MELTS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/69. V. I. Malkin and L. A. Schwarzman. London, Pergamon Press, Ltd., 1957. 8p.

1223

ELECTRON-EXCHANGE REACTIONS OF Fe(II)-Fe(III) AND Co(II)-Co(III) COMPLEXES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/211. F. S. Dainton, G. S. Laurence, W. Schneider, D. R. Stranks, and M. S. Vaidya. London, Pergamon Press, Ltd., 1957. 17p.

1224

CARBON-14 HOT ATOM CHEMISTRY OF n-PENTANE AND iso-PENTANE. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/201. C. S. Mackay and W. F. Libby. London, Pergamon Press, Ltd., 1957. 8p.

Reactions of C^{14} atoms of velocities corresponding to energies up to 40,000 ev have been studied in n-pentane and iso-pentane at about room temperature. C^{14} atoms were generated at the Argonne National Laboratory pile through the reaction of thermal neutrons in the $N^{14}(n,p)C^{14}$ process. Aniline was most often used as a source of nitrogen, but substitution of aliphatic amines gave similar results indicating that products were characteristic only of the hydrocarbon. A wide variety of hydrocarbons was formed. Hexane and pentane isomers were identified. Hexane isomers predominate, yields of individual compounds being up to 12%. The type and yield of compounds formed from n-pentane differ from those formed from iso-pentane. A mechanism is proposed. (auth)

1225

THE CHEMICAL REACTIONS OF RECOILING TRITIUM ATOMS WITH ORGANIC MOLECULES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/

RIC/203. F. S. Rowland and Richard Wolfgang. London, Pergamon Press, Ltd., 1957. 5p.

The high energy tritium atoms produced in nuclear reactions such as $Li^6(n,\alpha)H^3$ react directly with organic compounds and become incorporated in them. Work on simple gaseous alkanes shows that most of the recoil tritium can become chemically bound in stable molecules by a nonradical mechanism involving direct, high-energy replacement. A smaller fraction of the tritium reaches final chemical combination by further reaction, as thermalized species. Liquid alkanes show product distributions similar to those obtained for gaseous alkanes, and imply a similarity in mechanism in both phases. The primary labeled reaction products in liquid alcohols and acetone are also formed by simple reactions of the tritium atom with one target molecule. The reactions in solids are more complex, but the simple replacement of hydrogen by recoil tritium is still an important reaction for all molecules investigated. (auth)

1226

ANNUAL REVIEW OF PHYSICAL CHEMISTRY. VOLUME 8. H. Eyring, C. J. Christensen, and H. Johnston, eds. Palo Alto, Annual Reviews, Inc., 1957. 535p.

The following fields are reviewed: thermochemistry and thermodynamic properties of substances; cryogenics; solutions of electrolytes and diffusion in liquids; solutions of nonelectrolytes; the solid state; nuclear and electron magnetic resonance; radiation chemistry; quantum theory; high polymers in solution; kinetics of polymerization; surface chemistry and contact catalysis; electrode processes; kinetics of reactions in gases; kinetics of reactions in solution; organic reaction mechanisms; molecular electronic spectroscopy; vibration-rotation spectroscopy; experimental molecular structure, combustion and flames; the physical chemistry of proteins; bond energies; and ion-exchange resins and membranes. (T.R.H.)

1227

NUCLEAR CHEMICAL ENGINEERING. Manson Benedict and Thomas H. Pigford. New York, McGraw-Hill Book Company, Inc., 1957. 606p. $9.50.

This text describes the materials in nuclear reactors and the novel processes which were developed to concentrate, purify, and separate these materials. Included in the text are: the relationship between nuclear reactors and the chemical plants associated with them; principles of nuclear physics and radiochemistry; chemical properties, natural occurrence, concentration, purification, and conversion of U; properties and uses of Zr, Hf, Th, and Be; application of solvent extraction to separation of metals; properties of irradiated fuels; the separation of stable isotopes; and the separation of reactor products. (W.L.H.)

Analytical Procedures

1228 AERE-C/R-2392

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF CERTAIN TRACE IMPURITIES IN GRAPHITE BY RADIOACTIVATION. PART I. VANADIUM. A. A. Smales and D. Mapper. Dec. 1950. Decl. May 1957. 18p.

Declassified version of AERE-C/R-607.

A method is described for the analysis of V in graphite, involving no prior ashing of the sample and no chemical separations. The graphite sample is irradiated in the pile, together with a suitably chosen V standard, for 4 mins. At the end of this time, the activity due to the V in the sample and the standard is determined on the normal β-counting equipment, and the decay of the 3.7 minute V^{52} is followed for several half lives. From the relative activities of sample and standard the percentage V in the graphite is calculated. It is shown that, provided the graphite samples are homogeneous, reproducible results can be easily obtained. Alternatively, the method may be of use for determining the V content of small samples of graphite, e.g., with a view to testing homogeneity. (auth)

1229 NAA-SR-Memo-767

North American Aviation, Inc., [Downey, Calif.].

DETERMINATION OF TERPHENYL–BIPHENYL MIXTURES BY DIELECTRIC CONSTANT AND REFRACTIVE INDEX MEASUREMENTS. E. Colichman and S. Nakazato. Aug. 21, 1953. 9p. $1.80(ph OTS); $1.80(mf OTS).

1230 NP-6472

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE DETERMINATION OF HYDROGEN IN TITANIUM AND ITS ALLOYS—A CRITICAL REVIEW. T. D. McKinley. Sept. 23, 1957. 26p.

Theory, operational characteristics, and indicated precision and accuracy of analytical methods based on vacuum extraction, equilibrium pressure, and combustion approaches are reviewed. At the present time, vacuum extraction at 1400°C and the equilibrium pressure method are recommended for determination of hydrogen in titanium and titanium-rich alloys. (auth)

1231 TID-7015(Sec. 2)

Oak Ridge National Lab., Tenn.

ORNL MASTER ANALYTICAL MANUAL. SECTION 2. RADIOCHEMICAL METHODS. Nov. 1957. 304p. $6.50 (OTS).

Issued in loose-leaf form to facilitate periodic supplements.

1232 AEC-tr-3087

DETERMINATION OF ALUMINUM IN THE PRESENCE OF FLUORIDES WITH THE USE OF 8-HYDROXYQUINOLINE. V. A. Vasilev. Translated from Zavodskaya Lab. 6, 432-4(1937). 4p.

1233

FLUOROMETRIC URANIUM ANALYZER. J. T. Byrne (Dow Chemical Co., Denver, Colo.). Anal. Chem. 29, 1408-12(1957) Oct.

A fluorometric uranium analyzer has been constructed which, although simple in design, gives measurements that are virtually insensitive to line voltage variations of ±15 volts and to threefold changes in lamp intensity. An RCA 5819 photomultiplier tube detects the fluorescent light from the uranium–sodium fluoride phosphor, and a second 5819 tube monitors the incident ultraviolet light. The output of the second photomultiplier is fed to a series regulator tube, which adjusts the voltage (and sensitivity) of both photomultipliers to compensate for variations in lamp intensity and line voltage. (auth)

1234

MODIFIED DETERMINATION OF RADIUM IN WATER. F. B. Barker (U. S. Geological Survey, Denver, Colo.) and L. L. Thatcher (U. S. Geological Survey, Washington). Anal. Chem. 29, 1573-5(1957) Nov.

Amounts of Ra as low as 0.1 $\mu\mu$c can be detected by this simple method for routine determination of Ra in natural waters. Method embodies a barium sulfate carrier precipitation, filtration through a molecular filter membrane, and counting of activities after aging period. Accuracy is sufficient for many studies. (auth)

1235

DETERMINATION OF URANIUM IN NATURAL WATERS. L. L. Thatcher (U. S. Geological Survey, Washington) and

F. B. Barker (U. S. Geological Survey, Denver, Colo.). Anal. Chem. 29, 1575-8(1957) Nov.

The fluorophotometric method can be used for routine determination of U in solid residue from 10 ml of natural water. Three grams of high carbonate flux are used in a dilution procedure with spiking. A formula has been developed which corrects for comparatively high reflectivity of large disk. (auth)

1236

DETERMINATION OF PROTACTINIUM-233. F. L. Moore and S. A. Reynolds (Oak Ridge National Lab., Tenn.). Anal. Chem. 29, 1596-9(1957) Nov.

A liquid-liquid extraction system using diisobutylcarbinol as the organic phase is basis for a simple, rapid, control-type method for separation of Pa^{233}. Extraction is made from 6M hydrochloric acid–4% oxalic acid to inhibit extraction of Nb^{95}. If sample contains thorium, an extraction is first made without oxalic acid. (auth)

1237

DETERMINATION OF BORON IN TITANIUM ALLOYS BY ION EXCHANGE METHOD. E. G. Newstead and J. E. Gulbierz (Picatinny Arsenal, Dover, N. M.). Anal. Chem. 29, 1673-4(1957) Nov.

Boron is separated from Ti by passing a HCl solution of Ti^{4+} through a cation exchanger of the sulfonic acid type. An aliquot of the effluent is complexed with quinalizarin in H_2SO_4 and the complex titrated with water to a previously established color. (auth)

1238

TITRATION OF NITROAROMATIC AMINES AS ACIDS. James S. Fritz, Anthony J. Moye, and Marlene Johnson Richard (Iowa State Coll., Ames). Anal. Chem. 29, 1685-8(1957) Nov.

Anilines substituted in 2, 4, or 2, 4, 6, positions with at least two nitro groups, or with one nitro group and one or more chloro groups, can be titrated as acids in pyridine with triethyl-n-butylammonium hydroxide as titrant. Diphenylamine derivatives with nitro group in 4 position, trinitrotoluene, and trinitrobenzene can also be titrated. (auth)

1239

THE USE OF NAPHTHALENE DERIVATIVES IN INORGANIC ANALYSIS. PART II. THE NITRONAPHTHYLAMINES AS NEW REAGENTS FOR MERCURIC MERCURY AND CERIC CERIUM. J. L. Garnett and L. C. Lock (Univ. of Technology, Sydney, Australia). Anal. Chim. Acta 17, 351-5(1957) Oct.

The use of 4-nitro-1-naphthylamine as a spot test for Hg^{2+} and 1-nitro-2-naphthylamine as a specific spot test for Ce^{4+} have been observed. In each case, the reactions appear to be suitable for general qualitative inorganic analysis. The Ce^{4+} test was specific whereas in the case of Hg^{2+}, Ce^{+4} was the only ion of 51 tested which interfered. (auth)

1240

CONTINUOUS DETERMINATION OF C^{14} AND S^{35} IN AQUEOUS MEDIA BY A SCINTILLATION DEVICE — APPLICATION TO CHROMATOGRAPHIC EFFLUENTS. E. Schram and R. Lombaert. Anal. Chim. Acta 17, 417-22(1957) Oct. (In French)

A recording apparatus is described for determining soft radiation (C^{14}, S^{35}) in aqueous medium, especially adapted for continuous analysis of chromatographic effluents. It is based upon the spreading of the liquid in a thin layer in contact with a plastic scintillator coupled to a coincidence circuit. The efficiency is comparable to that of a thin end-window GM counter in the absence of auto-absorption. (auth)

1241

PURIFICATION OF SILVER CHLORIDE FOR SPECTROCHEMICAL USE. Drexel W. Baker (Goodyear Atomic Corp., Portsmouth, Ohio). Chemist-Analyst 46, No. 2, 56(1957) June.

1242

ANALYTICAL ASPECTS OF SOME ORGANIC COMPOUNDS. PART VI. 2-HYDROXY-3-NAPHTHOIC ACIDS IN THE DETERMINATION OF THORIUM AND ZIRCONIUM. Sachindra Kumar Datta (Darjeeling Gov't. Coll.). J. Indian Chem. Soc. 34, 531-6(1957) July.

2-Hydroxy-3-naphthoic acid and its acetyl, bromo, iodo, nitro, and nitroso derivatives have been used for the gravimetric determination of thorium and zirconium. Separation of thorium from the cerite earths and of thorium and zirconium from a number of foreign ions have been carried out with the bromo, iodo, nitro, and nitroso compounds. They may also be used for the extraction of thorium from monazite sands. A considerable amount of zirconium may be separated from a smaller quantity of thorium when present in a mixture. Separation of thorium from uranium with the bromo, iodo, and nitro compounds have also been described. (auth)

1243

NEUTRON ACTIVATION ANALYSIS OF SODIUM IN BLOOD SERUM. Richard P. Spencer, Thomas G. Mitchell, and E. Richard King (U. S. Naval Hospital and National Naval Medical Center, Bethesda, Md.). J. Lab. Clin. Med. 50, 646-52(1957) Oct.

1244

ACTIVATION ANALYSIS. Anil K. De (Jadavpur Univ., Calcutta). J. Sci. Ind. Research (India) 16A, 337-9(1957) Aug.

A brief survey of methods and instruments for activation analysis is presented. (J.E.D.)

1245

ISOTOPE EFFECTS IN GAS-LIQUID CHROMATOGRAPHY. Kenneth E. Wilzbach and Peter Riesz (Argonne National Lab., Lemont, Ill.). Science 126, 748-9(1957) Oct. 18.

1246

DETERMINATION OF U^{235} IN URANIUM OXIDES BY NEUTRON ACTIVATION. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/ND/RIC/49. S. May and P. Leveque. London, Pergamon Press, Ltd., 1957. 6p. (In French)

1247

INVESTIGATION OF THE SOLUBILITY OF LOW VOLATILITY SUBSTANCES IN HIGH PRESSURE STEAM IN RADIOISOTOPES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/73. M. A. Styrikovich. London, Pergamon Press, Ltd., 1957. 11p.

Radioisotopes were used to determine accurately the very small concentrations of substances dissolved in steam. (T.R.H.)

Deuterium and Deuterium Compounds

1248

PREPARATION AND BEHAVIOR OF SOME CATALYSTS FOR THE ISOTOPIC EXCHANGE REACTION OF DEUTERIUM BETWEEN HYDROGEN AND WATER VAPOR. B. Brigoli, E. Cerrai, R. Renzoni, and M. Silverstri (Lab. CISE, Milano). Nuovo cimento (10) 5, Suppl. No. 3, 479-539(1957). (In Italian)

Methods of preparation of Ni, Pt, Cu, and Fe catalysts

are presented. The apparatus for experiments with these catalysts is diagramed for rapid measurements in pyrex and brass and for high temperature reactions. Results are tabulated. (M.H.R.)

Fluorine and Fluorine Compounds

1249 NP-6463

Massachusetts Inst. of Tech., Cambridge.

THE FLUORINATION OF CARBIDES. Final Report. James R. Aronson. Oct. 15, 1957. 28p. Contract Nonr-1841 (07).

A group of seven carbides (SiC, B_4C, Cr_3C_2, Fe_3C, TiC, Al_4C_3, and CaC_2) representative of the various structural types has been fluorinated using elementary fluorine gas. All reactions yielded similar mixtures of low molecular weight fully saturated fluorocarbons, and there appears to be no observable correlation between the composition of the fluorocarbon mixture and the structure of the carbides. Techniques employed include infrared spectroscopy and vapor phase chromatography. Further work is in progress, in which fluorinating agents other than the elementary gas will be employed. (auth)

1250 AEC-tr-3066

BECKMANN REARRANGEMENT IN TRIFLUOROACETIC ACID. Milos Hudlicky. Translated from Chem. listy 51, 470-3(1957). 6p.

Trifluoroacetic acid proved itself to be a good medium for the Beckmann rearrangement of ketoximes. The process of reaction is easily controlled, and the product can be readily isolated by distilling out trifluoroacetic acid. Acetophenone oxime, benzophenone oxime, and cyclohexane oxime were rearranged in yields of 53, 88 and 62.5%, respectively. In case of cyclohexane oxime it was observed that the rearrangement proceeds by a first order reaction. (auth)

1251

THE SYSTEMS CaF_2-LiF AND $CaF_2-LiF-MgF_2$. W. E. Roake (General Electric Co., Richland, Wash.). J. Electrochem. Soc. 104, 661-2(1957) Nov.

Temperature-composition relationships have been measured in the CaF_2-LiF and the $CaF_2-LiF-MgF_2$ systems in the areas of liquidus temperatures below 1000°C. A binary eutectic composition of 80.5 mole % LiF and 19.5 mole % CaF_2 was observed to melt at 769°C. A ternary eutectic composition of 59.0 mole % LiF, 2.9 mole % MgF_2, and 13.1 mole % CaF_2 was observed to melt at 672°C. (auth)

Graphite

1252 HW-52375

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PRELIMINARY STUDY OF THE EFFECT OF NEUTRON IRRADIATION AND OXIDATION AT MODERATE TEMPERATURES ON THE STRUCTURAL CHARACTERISTICS OF CSF GRAPHITE. R. E. Woodley. Sept. 4, 1957. Decl. Oct. 11, 1957. 20p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

Nitrogen adsorption and desorption measurements, pore size distribution calculations, bulk and He density determinations, and x-ray measurements were performed on a series of CSF graphite samples irradiated at a temperature of about 400°C to establish the reality of crystallite breakup upon irradiation to exposures in the range of 1600 to 4500 Mwd/ct. Because it appeared that some oxidation had also occurred, a complementary series of measurements were performed on virgin samples of CSF graphite which had been oxidized to various extents. The results indicate that crystallite breakup does occur but that the surface area created thereby is not necessarily accessible to nitrogen adsorption. A more vigorous experimental approach to this problem is proposed. (auth)

1253 AEC-tr-3083

THE DETERMINATION OF VARIATIONS IN THE LATTICE PARAMETERS OF VARIOUS GRAPHITES. Ferdinand M. Kessler. Translated from Chem. listy 51, 13-20(1957). 11p.

An evaluation of the existing methods of determination of the lattice parameters of graphite was made, and the advantages of the use of the new method were described. During the powdered diffraction analysis the x radiation of the Cr anode was used for the first time with an asymmetric placing of the film. The advantages and precision of this method are obvious from its application in the determination of lattice intervals of the rhombohedral modification of the graphites and the tracing of the variations in interlattice spacing of graphitized carbon raw materials in dependence on heat. (auth)

1254

NOTE ON A GRAPHITE-SAMPLE WITH X-RAY DIAGRAMS FREE OF »ORIENTATION-EFFECT«. S. Maricic and M. Wrischer (Inst. »Ruđer Bošković«, Zagreb, Yugoslavia). Croat. Chem. Acta 28, 307-10(1956).

1255

GRAPHITE IN NUCLEAR POWER INDUSTRY. SUMMARY OF PAPERS PRESENTED AT SESSION 5 OF THE GRAPHITE SYMPOSIUM ORGANIZED BY THE SOCIETY OF CHEMICAL INDUSTRY. Nuclear Eng. 2, 441-2(1957) Oct.

Three papers were presented on the physical properties of graphite as affected by high temperature and irradiation, fabrication problems, and developments in gas purification of graphite. (M.H.R.)

Laboratories and Equipment

1256 AERE-CE/R-2201

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FLOOD-POINT DATA FOR "SPRAYPAK" COLUMN PACKINGS AT HIGH LIQUID RATES. F. R. Dell. May 1957. 13p.

The flood-point data for SPRAYPAK given in earlier reports have been extended to high liquid rates, using the air–water system. It has been found that the earlier correlation did not express accurately the effects of course height and mesh strand width on the flood point under these conditions, and for practical design purposes a separate modified correlation is given for high liquid-gas ratios. (auth)

1257 CEA-656

France. Commissariat à l'Énergie Atomique, Paris.

VENTILATION DES ENCEINTES RADIOACTIVES. (Ventilation of Radioactive Enclosures). F. Caminade and H. Laurent. May 1957. 19p.

This study deals with the individual equipment of small installations: glove boxes, manipulation boxes with outside control and, if necessary, production chambers (maximum useful volume: 5 m^3). The performance of three types of "ventilators", and the modifications provided by the addition of filters, are measured and compared. (auth)

1258 HE-150-103

California. Univ., Berkeley. Inst. of Engineering Research.

A HIGH OUTPUT SOURCE OF 1470A RADIATION. R. A.

Evans. Aug. 8, 1952. 9p. Contract AF-33(038)-8896.

A source of 1470A radiation was developed as a component for the O_2 absorption method of flow visualization for rarefied gases. This type of Xe discharge lamp was first mentioned in the literature in 1932 and then in 1937 as equipment to aid in photochemical research. Recently, research on a similar source has been carried out at Moffett Field by the NACA and at Baird Associates, Inc. The source described has been developed during the last three years and consists of a hot cathode low pressure xenon discharge lamp which is monochromatic in the 1470A region and has a relatively high output there. (auth)

1259 HW-51884

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUG–PISTON PULSE GENERATOR. V. P. Kelly. Aug. 12, 1957. 11p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A graphite plug-piston assembly with a stainless steel cylinder and a piston rod sealed by a lower throttle bushing and upper Teflon chevron packing was operated 25 million cycles pulsing liquid in 3- and 4-inch-diameter process columns. During operation to an annulus between the rod seals, no measurable piston leakage was observed. Without the air purge, or with the air purge between the piston and throttle bushing, piston leakage rates up to one gal/hr occurred. The CSGBF graphite piston wore four mils (diametrally) during the first half of the test, with no change thereafter. The wear rate of Polypenco K-51 throttle bushing was one-third that of pile graphite. A hardened 17-4 PH stainless steel piston rod and cylinder showed no wear. (auth)

1260 HW-52051

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A HYDRAULIC POWER UNIT FOR SOLVENT EXTRACTION COLUMN PULSE GENERATORS. V. P. Kelly. Aug. 23, 1957. 13p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

A power unit comprised of a reciprocating hydraulic cylinder controlled by hydraulic, mechanical, and electrical elements was developed to drive pulse generators for solvent extraction columns in the Purex Hot Semiworks. Design bases included remote control of continuously-variable pulse amplitudes between ½ and 1½ inches, and pulse frequency up to 120 cycles/min. Each of nine power units operated 30 to 60 million cycles without serious difficulty, although minor modifications and corrections were made during scheduled shutdowns of the Semiworks. Operational irregularities, such as erratic or drifting amplitudes, occurred with sufficient frequency to indicate deficiencies in the original design. The triangular pulse wave which is characteristic of the power unit was suspected on several occasions as having an adverse effect on extraction column performance. However, no correlation was found to show that column performance is adversely affected by a triangular pulse. (auth)

1261

VENTILATING RADIOLOGICAL LABORATORIES. Melville G. Kershaw (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 15-24(1956).

Basic concepts and a description of successful solution to ventilating problems encountered in radiological laboratories are given. Radioactive contaminants, solid or gaseous, must be confined, controlled, collected, removed or diluted to prevent recirculation or contamination of surrounding areas. The control of radioactive contamination requires proper partitions, enclosures, hoods, etc. Air must flow from clean areas toward and into the more contaminated areas. (auth)

1262

THE CONTAINMENT PHILOSOPHY AT THE SAVANNAH RIVER LABORATORY. A. J. Hill, Jr. (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 25-6(1956).

The application of the containment method of working with radioactivity at the Savannah River Laboratory is reviewed. The method requires the radioactive materials to be isolated from the worker insofar as practical and has been successfully used for several years at the Radiation Laboratory of the University of California. The organization and functions of the Savannah River Laboratory Radiation Control Group, which furnishes the services necessary to work within the scope of the containment philosophy, are described, and the advantages resulting from the method evaluated. (auth)

1263

GENERAL CHARACTERISTICS AND EQUIPMENT OF A RADIOCHEMICAL LABORATORY. F. Gadda and A. Scaroni. Energia nucleare (Milan) 4, 379-90(1957) Oct. (In Italian)

The basic rules connected with the construction and the operation of a low level radiochemical laboratory are given together with the approximate prices for the installation of special equipment. (auth)

Radiation Chemistry

1264 56-RL-1623

General Electric Co. Research Lab., Schenectady, N. Y.

RADIATION CHEMISTRY OF ORGANIC COMPOUNDS. I. SATURATED ALIPHATIC HYDROCARBONS. H. A. Dewhurst. Sept. 1956. 21p.

A series of n-alkane liquids, pentane to hexadecane, were irradiated with 800 kvp electrons. The H_2 yield, $G(H_2) \sim 4.9$, was found to be independent of the length of the C atom length, whereas the methane yield decreased with increase in the length of the C atom chain. Infrared analysis has shown that the unsaturation produced is largely trans vinylene with a smaller amount of vinyl. Gas-liquid partition chromatography has shown that three primary product groups are formed; a dimer group, an intermediate group between the dimer and parent, and a degradation group. These results show that C–C bond scission is an important process, contrary to conclusions based only on gas analysis. (auth)

1265

THE REDUCTION OF PLUTONYL SULFATE BY GAMMA RAYS. Monique Pagès, Christiane Ferradini, and Moïse Haïssinsky. Compt. rend. 245, 1128-9(1957) Sept. 30. (In French)

1266

KINETICS OF HYDROGEN PEROXIDE DECOMPOSITION BY γ RADIATION. V. Ya. Chernykh, S. Ya. Pshezhetskiĭ, and G. S. Tyurikov. (Karpov Physico-Chemical Inst.). Doklady Akad. Nauk S.S.S.R. 115, 560-3(1957) July 21. (In Russian)

Kinetics of the H_2O_2 decomposition reaction in a wide range of aqueous concentrations (2 to 92 mole % H_2O_2) under the action of γ radiation were investigated, and comparisons were made of some kinetic regularities of thermal and photo-reactions in the same range of concentrations. (R.V.J.)

1267

RETARDATION OF A RADIOCHEMICAL REACTION BY CHARGE TRANSFER IN A BIMOLECULAR MIXTURE OF

GASES. S. C. Lind and P. S. Rudolph (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 26, 1768-9(1957)

1268

CHEMICAL EFFECTS OF IONIZING RADIATION ON AQUEOUS SOLUTIONS OF VANADIUM. I. REDUCTION OF PENTAVALENT VANADIUM IN ACID MEDIUM BY GAMMA RAYS FROM RADIOCOBALT. Jacques Pucheault and Christiane Ferradini. J. chim. phys. 54, 659-68(1957) Sept. (In French)

1269

RADIATION-INDUCED EXCHANGE OF HYDROGEN ISOTOPES: CHAIN INHIBITION. Leon M. Dorfman and F. J. Shipko (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Phys. Chem. 59, 1110-11(1955).

1270

ROLE OF RADIATION IN GRAFT AND BLOCK COPOLYMER SYNTHESIS. D. S. Ballantine (Brookhaven National Lab., Upton, N. Y.). Modern Plastics 35, No. 1, 171-4, 176(1957) Sept.

1271

RADIOLYSIS OF AQUEOUS SOLUTIONS OF HYDROCARBONS BENZENE, BENZENE-d_6, CYCLOHEXANE. P. V. Phung and Milton Burton (Univ. of Notre Dame, Ind.). Radiation Research 7, 199-216(1957) Sept.

1272

THE ACTION OF X-RAYS ON COCARBOXYLASE. M. Ebert and A. J. Swallow (Hammersmith Hospital, London and Univ. of Cambridge). Radiation Research 7, 229-35(1957) Sept.

1273

NEW TECHNIQUES FOR THE PRECISION MEASUREMENT OF GAMMA RAYS AND FAST NEUTRONS WITH CHEMICAL DOSIMETERS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/3. G. V. Taplin. London, Pergamon Press, Ltd., 1957. 16p.

Chemical dosimeters prepared from chlorinated hydrocarbons and pH indicator dyes are described along with the modified analytical techniques employed for radiation measurement. The principle underlying these systems is the direct relation between soluble acids generated from chlorinated hydrocarbons and radiation dose. The aqueous indicator dyes register acid production by visible color changes, reduction in pH and decrease in optical density, thus permitting measurement of radiation dose by color comparison, acidometric analysis, pH measurement or photoelectric colorimetry. (auth)

Radiation Effects

1274 NP-6452

Denver. Univ. Denver Research Inst.

DETERMINATION OF THE RELATIONS BETWEEN STRUCTURE AND RADIATION STABILITY OF VARIOUS CLASSES OF ALKYL-AROMATIC FLUIDS. Quarterly Progress Report No. 1 (Part I) [for] July–September 1957. Josef J. E. Schmidt. Sept. 1957. 15p. Project No. 7(1-7331). Contract AF33(616)-5317.

Work accomplished during the first quarter of the contract included preliminary and preparatory steps in all of the three parts of the research phases: (a) Synthesis and purification program, (b) Irradiation program, and (c) Analytical program. A literature survey of the radiation chemistry of organic fluid compounds in general and that of polyaromatic and condensed aromatic compounds in particular was conducted. A series of compounds selected for irradiation have been prepared and purified. Analytical procedures, purification procedures and methods such as gas phase chromatography, liquid phase chromatography and high temperature gas chromatography have been investigated for their applicability to the separation of polyphenyls, alkyl polyphenyls and other polyphenyls derivatives as well as for the separation of polycondensed aromatic compounds and their derivatives. A 200 stage countercurrent (Craig-Type Countercurrent Distribution) Apparatus is being installed and adapted for purification and separation techniques. The Co^{60} gamma radiation source has been calibrated by the ferrous sulfate and ceric sulfate methods, irradiation cells have been designed and fabricated, and additional calorimetric calibration is under way. (auth)

1275

THE INFLUENCE OF WATER CONTENT ON THE ACTION OF IONIZING RADIATION ON STARCH. L. Ehrenberg, M. Jaarma, and E. C. Zimmer (Inst. of Organic Chemistry and Biochemistry, Univ., Stockholm, Sweden). Acta Chem. Scand. 11, 950-6(1957).

1276

RATES OF CHLORINATION OF AROMATIC HYDROCARBONS IN THE PRESENCE OF GAMMA RADIATION. David E. Harmer, Joseph J. Martin, and Leigh C. Anderson (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 53-9(1956).

The broad problem of chlorination of aromatic compounds is treated, with emphasis given to the chlorination of toluene. Some halogenated aromatics received attention, and the effect of impurities was considered. (M.H.R.)

1277

POLYMORPHISM AND RADIATION DECOMPOSITION OF CHOLINE CHLORIDE. Robert L. Collin (New England Deaconess Hospital, Boston, Mass.). J. Am. Chem. Soc. 79, 6086(1957) Nov. 20.

1278

THE FORMATION OF INTERNAL GAS BUBBLES IN SOLIDS. R. S. Barnes (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Nuclear Energy 5, 301-19(1957).

Gas bubbles produced internally in polymethyl methacrylate by heating or by irradiation have been studied. In the center of a sample gas bubbles form after an incubation period and then grow, whereas in the surface layers, from which gas is evolved, no bubbles form. Pressure applied during the heating of samples can prevent the gas formed from precipitating. Samples in which the gas has been produced by heating contain a number of bubbles per unit volume which is a constant, but in irradiated samples this number varies depending upon the flux or the subsequent heating. The results are used to discuss the physics of the nucleation of gas bubbles in solids, and in particular the swelling which occurs in uranium upon irradiation with neutrons. (auth)

1279

COMBINED EFFECT OF VACCINIA VIRUS AND X-RAYS ON THE TRANSPLANTABILITY OF MOUSE ASCITES TUMOR. N. P. Mazurenko and A. A. Lemberg (Kharkov Roentgen-oncological Inst.). Problems of Oncology 3, 193-4 (1957).

1280

THE EFFECT OF γ-IRRADIATION UPON POLY (ETHYLENE OXIDES). Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/21. R. W. Pearson. London, Pergamon Press, Ltd., 1957. 7p.

Rare Earths and Rare-earth Compounds

1281

THE THERMAL DECOMPOSITION OF THE 5,7-DIHALO-8-QUINOLINOL RARE EARTH METAL CHELATES. Wesley W. Wendlandt (Texas Tech. Coll., Lubbock). Anal. Chim. Acta 17, 428-33(1957) Oct.

The thermal decomposition of the 5,7-dichloro-, 5,7-dibromo- and 5,7-diiodo-8-quinolinol chelates of La, Ce, Pr, Nd, Sm, and Y was investigated on the thermobalance. The chelates decomposed in the temperature range from 65 to 125°C while the oxide levels were obtained from 395 to 805°C. Although the chelate thermal stability temperatures varied little with the chelating agent, the minimum oxide level temperatures were largely dependent on the halogen substitution on the 8-quinolinol molecule. Results of this study were correlated with previous studies on the rare earth metal chelates with 8-quinolinol and 2-methyl-8-quinolinol. (auth)

1282

ABSORPTION SPECTRA OF DYSPROSIUM(III), HOLMIUM(III), AND ERBIUM(III) AQUO IONS. Chr. Klixbüll Jørgensen (Tech. Univ. of Denmark, Copenhagen). Acta Chem. Scand. 11, 981-9(1957).

The narrow f^n-bands of aqueous Dy^{3+}, Ho^{3+}, and Er^{3+} perchlorates are measured in the range 800–210 mμ. The application of the theory of Slater, Condon, Shortley, and Racah to the distribution of multiplet terms is discussed. The lowest term with the total spin S one unit lower than of the groundstate often decays with fluorescence in the lanthanides and actinides. (auth)

1283

SEPARATION OF CERTAIN RARE EARTH ELEMENTS BY A DRY METHOD. APPLICATION TO SAMARIUM AND EUROPIUM. Jean-Claude Achard. Compt. rend. 245, 1064-6(1957) Sept. 23. (In French)

The results obtained for Sm and Eu are analogous to those for Yb previously reported. Work is described on the purification of Sm and Eu, separation of other rare earths, and preparation of the protoxides and corresponding metals. (T.R.H.)

1284

LANTHANUM TRIURANATE. Jean Moehrlé. Compt. rend. 245, 1138-40(1957) Sept. 30. (In French)

A study of the reaction of La_2O_3 with a solution of a uranyl salt (acetate or nitrate) resulted in discovery of the compound $(U_3O_{10})La_2$. It is stable up to 550°C. It is not attacked by acids of pH to 5.37. (tr-auth)

1285

RARE EARTH GRAPHITE INTERCALATES. R. C. Vickery and N. Lucile Campbell (Horizons, Inc., Cleveland, Ohio). J. Am. Chem. Soc. 79, 5897-9(1957) Nov. 20.

Intercalation in graphite of the whole series of rare earth chlorides has been investigated and some disagreements found with pre-existing incomplete studies. Only yttrium and gadolinium chlorides are found to intercalate consistently and in appreciable quantities. The light lanthanons do not intercalate, and inconsistent intercalation of heavy lanthanous appears attributable to variable degrees of hydration of the parent chlorides. Hall coefficient and magnetic susceptibility measurements confirm that the intercalates are ionic, while x-ray studies appear to confirm beliefs that the ions are located at imperfections in the graphite lattice. There appears some foundation for believing that ionic size and electronic structure are the major factors influencing intercalation. (auth)

1286

ELASTIC PROPERTIES OF YTTRIUM AND ELEVEN OF THE RARE EARTH ELEMENTS. J. F. Smith and F. H. Spedding (Iowa State Coll., Ames) and C. E. Carlson (Pratt and Whitney Corp., East Hartford, Conn.). J. Metals 9, 1212-13(1957) Oct.

Elastic constants of Y, La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, and Yb were measured. (W.L.H.)

Separation Procedures

1287 BNL-470

Brookhaven National Lab., Upton, N. Y.

ACCIDENT IN CONTINUOUS-DISSOLVER PILOT PLANT OF FLUORIDE VOLATILITY PROJECT ON MAY 15, 1957. Gerald Strickland, F. L. Horn, Richard Johnson, and O. E. Dwyer. July 10, 1957. Revised Aug. 20, 1957. 44p. $9.30(ph OTS); $3.60(mf OTS).

A series of explosions, estimated at five, occurred over a period of ten seconds within the continuous dissolver pilot plant, of the Fluoride Volatility Project on May 15, 1957. The explosive reactions occurred in the dissolver vessels as a result of violent chemical reactions between uranium and an interhalogen mixture. Just what the conditions were which triggered the explosions, have not been definitely established. Nevertheless, based upon the evidence which has been collected, several possible explanations, listed according to probability, are presented. A number of recommendations are included to be followed before operation of the pilot plant is resumed. These recommendations relate to additional laboratory research, equipment design, facility design, and use of a review committee. Safety rules for handling BrF_3, BrF_5, ClF_3, and Br_2 are appended. (C.H.)

1288 HEC-79

Hooker Electrochemical Co., Niagara Falls, N. Y.

AEC RESEARCH AND DEVELOPMENT QUARTERLY REPORT FOR APRIL, MAY, AND JUNE 1957. G. T. Miller. Aug. 22, 1957. 22p. Contract AT(30-1)-1524. $4.80(ph OTS); $2.70(mf OTS).

Phase I is concerned with the separation of boron isotopes 10 and 11. The presently used method of separation of boron isotopes is that of an association-dissociation reaction employing the dimethyl ether-boron trifluoride complex. In that the BF_3 containing B^{10} associates with dimethyl ether at a slightly greater rate than BF_3 containing the B^{11} isotope, the liquid phase becomes enriched in B^{10} and the vapor phase becomes enriched in B^{11}. The reaction is carried out in extremely effective continuous fractionation columns, the B^{10} enriched complex being recovered from the bottoms. A second method for the separation of boron isotopes is in the development stage. This method involves an association-dissociation process using an anisole-boron trifluoride complex. The method is dependent on an exchange between BF_3 gas and anisole-boron trifluoride liquid complex. The desired boron-10 isotope is concentrated in the liquid phase. The boron isotope separation factor is greater for the anisole-BF_3 complex system than for the dimethyl ether-BF_3 system. Increased production of B^{10} or new construction would be expected to profit from the successful development of the anisole-BF_3 system. Phase II is concerned with the reduction of boron compounds (product of Phase I) to the elemental form. Although hydrogen reduction of boron trichloride using a hot wire was used in plant operations, fused salt electrolysis is used at present. The process involves the electrolysis of potassium fluoroborate in a potassium chloride melt. Research work is primarily directed at increasing the recovery of boron. (auth)

1289 HEC-80

Hooker Electrochemical Co., Niagara Falls, N. Y.

BORON ISOTOPE SEPARATION WITH ANISOLE–BORON

TRIFLUORIDE COMPLEX. Kenneth O. Hambrock. Aug. 26, 1957. 38p. Contract AT(30-1)-1524. $6.30(ph OTS); $3.00(mf OTS).

Three aspects of the anisole–BF_3 system for B isotope separation were investigated: metal corrosion in anisole at reflux temperatures in the presence of BF_3, both with and without water, anisole decomposition in the presence of varying water content, and anisole purification methods. An analytical distillation technique for determining anisole decomposition is described. The properties of a new azeo trope, n-dodecane and phenol, are reported. Recommended materials of construction, anisole purity, and decomposition product tolerances are given for design purposes. (auth)

1290 HEC-81

Hooker Electrochemical Co., Niagara Falls, N. Y.

AEC RESEARCH AND DEVELOPMENT QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER 1957. G. T. Miller. Oct. 8, 1957. 15p. Contract AT(30-1)-1525. $3.30(ph OTS); $2.40(mf OTS).

An investigation is in progress on the effects of impurities in the electrolyte on the yield and purity of B produced in an electrolytic cell. Initial work on reclaiming B values from spent electrolyte indicates 75% or more of the B is reclaimable by simple solubility techniques. The work is not complete. The effects of down time, addition of elemental K and pelletization of KBF_4 on yield and purity of B are in progress. A semi-continuous cell is waiting for a pelletizing press with which to prepare the electrolyte feed. An investigation of materials of construction for the anode retaining shell has demonstrated that Durachlor and SS-316 are unsuitable materials. The work is continuing. Re-evaluation of finishing room operations has indicated that degradation of the product probably does occur during the finishing room process. Insufficient data have been obtained to know what the degrading mechanism is. (auth)

1291 HW-48776 RD

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FISSION PRODUCT RECOVERY FROM CHEMICAL PROCESSING PLANT WASTE SOLUTIONS. G. B. Barton, J. L. Hepworth, E. D. McClanahan, Jr., R. L. Moore, and H. H. Van Tuyl. Feb. 26, 1957. Decl. July 25, 1957. 25p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

A process is described for the recovery of potentially valuable long-lived fission product activities from the first cycle acidic waste solutions which result from the solvent extraction processing of nuclear reactor fuel elements. The metal ferricyanides and ferrocyanides were extensively investigated as scavenging agents for Cs^{137}, and the effects of process variables are reported. Cesium zinc ferrocyanide was found to be the most effective and is used for purposes of concentration and isolation. Subsequent chemical processing results in either a mixed chloride or pure cesium chloride product suitable for use in high intensity radiation sources. $Cerium^{144}$, rare earth, and Sr^{90} activities are recovered by a series of process steps which depend on co-precipitation on ferric hydroxide and on the solubility behavior of the rare earth oxalates, of cerium(IV) iodate, and of strontium carbonate. (auth)

1292 IDO-14412

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ANALYTICAL PROGRAM FOR PROCESSING ALUMINUM–URANIUM REACTOR FUEL ELEMENTS. Ralph C. Shank and James E. Rein. Aug. 15, 1957. 18p. Contract AT(10-1)-205. $0.75(OTS).

The function of the Idaho Chemical Processing Plant is to process fuel elements containing uranium enriched in the isotope 235 for recovery of the unfissioned U. A major throughput of the plant is the solid Al–U type element. The plant process is based on acid dissolution, then separation of the U from the Al cladding and fission products by liquid-liquid extraction. It is the purpose of this paper to describe the analytical program for this process. The high concentration of fission products, as much as several hundred roentgens of gamma radiation per hour per ml in certain of the samples, complicates the analytical scheme. A facility for remote analysis is required and the fission products, chemically complex and present in multioxidation states, interfere with many analytical methods. Methods are described for U, acidity, beta and gamma activity, and specific gravity in the dissolver solution; for small amounts of uranium in the extraction column raffinates; and for U in the final product. The extensive quality control program that is maintained is summarized. Typical reliability data are given for each of the described analytical methods. (auth)

1293 IDO-14413

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ANALYTICAL PROGRAM FOR PROCESSING ZIRCONIUM–URANIUM REACTOR FUEL ELEMENTS. James E. Rein and Ralph C. Shank. Aug. 15, 1957. 28p. Contract AT(10-1)-205. $1.00(OTS).

Fuel elements fabricated with zirconium as the alloying material are rapidly gaining in popularity. Recently, a high zirconium content, enriched uranium fuel was processed in the Idaho Chemical Processing Plant for recovery of the unfissioned uranium. The process was based on dissolution in hydrofluoric acid, oxidation of uranium(IV) to uranium(VI) with chromium(VI), complexation of the free fluoride with aluminum(III), and separation of the uranium by pulsed column extraction with tributylphosphate in kerosene. It is the purpose of this paper to describe the analytical program for this process. Because of the high burnup of uranium, the samples contained high concentrations of fission products which are chemically complex and interfere with conventional methods of analysis. The high activity level of the samples required use of a special remote handling facility. Methods are described for uranium, acidity, zirconium, aluminum, fluoride, and specific gravity in the dissolver and column feed solutions; for small amounts of uranium in the extraction column raffinates; and for tributylphosphate in the extractant. Typical reliability data are given for each of the described analytical methods. (auth)

1294 LA-1692

Los Alamos Scientific Lab., N. Mex.

CALCIUM OXALATE CARRIER PRECIPITATION OF Pu. W. J. Maraman, A. J. Beaumont, E. L. Christensen, A. V. Henrickson, J. A. Hermann, K. W. R. Johnson, L. J. Mullins, and R. S. Winchester. Feb. 25, 1954. Decl. Oct. 28, 1957. 9p. Contract W-7405-Eng-36. $1.80(ph OTS); $1.80(mf OTS).

A plant-scale procedure for concentrating Pu and Am in slag and crucible (metal reduction residues) and other recovery solutions by a calcium oxalate carrier precipitation is described. Conclusions from exploratory laboratory tests on the variables affecting the efficiency are included. (auth)

1295 NYO-7567

Boston Univ.

THE DISTRIBUTION OF BISMUTH NITRATE FROM AQUEOUS SOLUTIONS TO ETHERS AND METHYL ISOBUTYL KETONE (HEXONE). Arno H. A. Heyn and

Gurupada Banerjee. July 22, 1957. 27p. Contract AT(30-1)-1873. $0.75(OTS).

In order to obtain data on the degree of interference of Bi in $UO_2(NO_3)_2$ extractions the distribution of $Bi(NO_3)_3$ between either $Al(NO_3)_3-HNO_3$ solution or $Ca(NO_3)_2-HNO_3$ solution and diethyl ether, isopropyl ether, n-butyl ether, and methyl isobutyl ketone (hexone) was investigated. In case of diethyl ether, the extraction ratio was found to be largely independent of bismuth nitrate concentration, to decrease with decreased HNO_3 at high $Al(NO_3)_3$ concentrations and to remain almost constant at high $Ca(NO_3)_2$ concentrations. Using diethyl ether as an extractant, extraction ratios (org/aq.) of 0.047 and 0.033 were obtained with aliquot quantities of 2.5M $Al(NO_3)_3-3N$ HNO_3 solution and 3.75M $Ca(NO_3)_2-3N$ HNO_3 solution, respectively, at a total nitrate concentration of 7.5M. The extraction of $Bi(NO_3)_3$ from $Al(NO_3)_3-HNO_3$ and $Ca(NO_3)_2-HNO_3$ solutions with isopropyl ether gave maximum extraction coefficients of 0.042 and 0.026, respectively. Nitric acid increases the distribution from that of the neutral salt solution to a maximum at a normality of 3.0. A very small amount of $Bi(NO_3)_3$ will be extracted from aqueous solution by n-butyl ether if high concentrations of $Al(NO_3)_3$ and $Ca(NO_3)_2$ are added to water. The maximum extraction ratios of Bi from $Al(NO_3)_3-HNO_3$ and $Ca(NO_3)_2-HNO_3$ solutions were 0.025 and 0.024, respectively, and were found to decrease with decreased HNO_3 concentration. The above extraction ratios of $Bi(NO_3)_3$ with hexone were almost independent of HNO_3 concentration and gave maximum values of 0.040 and 0.054 at 3M HNO_3 concentration, using $Al(NO_3)_3$ and $Ca(NO_3)_2$ as salting agents, respectively. Ethers show definite promise as extractants for the separation of U from Bi in a continuous extraction process. (auth)

1296 WASH-743

Division of Civilian Application, AEC.

SUMMARY REPORT; AEC REFERENCE FUEL-PROCESSING PLANT. Oct. 1957. 30p. $1.00(OTS).

A conceptual design is presented of a multipurpose chemical processing plant for the processing of spent reactor fuel elements. The concept chosen uses a number of parallel dissolution systems with a common aqueous extraction system based on the Purex Process. The dissolution systems were chosen to dissolve U-Zr, U-stainless steel, combination alloys such as U-Mo and U-Nb, and fuels involving combinations of U, Zr, and stainless steel in a single element. Schematic flow diagrams are included for the over-all plant, dissolution processes, a radioactive off-gas facility, the extraction system, and processing procedures for various fuel types. Data are tabulated from capitol cost estimates for the reference multipurpose plant, operating cost estimates, and the capital and operating costs for individual fuel types. A standard daily chemical processing charge of $15,300 was established. The charge is made for the time a fuel is using the plant for extraction plus time for shutdown, cleanup, and startup. (C.H.)

1297 WIN-77

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

THE ALKALINE LEACH-RESIN-IN-PULP PROCESS AS APPLIED TO TODILTO, MESA TOP, AND LA SAL ORES. P. N. Thomas and R. L. Shimmin. Sept. 10, 1957. 106p. Contract AT(49-6)-924. $16.80(ph OTS); $5.70(mf OTS).

Test work toward development of the alkaline leach resin-in-pulp process was conducted on Todilto, Mesa Top, and La Sal ores. Data on leaching, reagent recovery, sand-slime separation, ion exchange, and precipitation characteristics of these ores are given which show that they are amenable to the process. (T.R.H.)

1298

EVALUATION OF RADIOCHEMICAL SEPARATION PROCEDURES. Duane N. Sunderman and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem. 29, 1578-89 (1957) Nov.

Radiochemical separation procedures for Ba, Sr, Ca, and Ag are evaluated. Conditions for optimum radiochemical separation of these three alkaline earths and procedures for systematic separation in tracer solutions are given. Two standard and two new methods for separation of radioactive silver are studied. Effectiveness of ferric and lanthanum hydroxides as scavengers on radioactive tracers is also evaluated. (auth)

1299

PREPARATION OF RADIOCHEMICALLY PURE CERIUM BY SOLVENT EXTRACTION. H. W. Kirby (Mound Lab., Miamisburg, Ohio). Anal. Chem. 29, 1599-1601(1957) Nov.

Radiochemically pure Ce can be prepared rapidly and inexpensively from reagent grade cerous nitrate by liquid-liquid extraction with tri-n-butyl phosphate. Ce and Th are extracted into TBP. Ce is stripped from organic phase with 8N HNO_3. Product contains 80% of Ce and less than 2% of original radioactivity. (auth)

1300

LONG-CHAIN AMINES. VERSATILE ACID EXTRACTANTS. Fletcher L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem. 29, 1660-2(1957) Nov.

A new anionic liquid-liquid extraction technique uses solutions of long-chain amines in chloroform to extract acids on complex metal acids from aqueous solutions. Extractions of some anionic complexes of Po, Pu, Zr, and Pa are demonstrated. (auth)

1301

AUTOMATIC SOLVENT EXTRACTION APPARATUS AND METHOD FOR URANIUM. C. A. Kienberger (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Anal. Chem. 29, 1721-2(1957) Nov.

A simple and inexpensive extractor of unique design is described which can be constructed by the average chemist-glassblower. (L.T.W.)

1302

COSTS ON NEW PROCESSES FOR SOLVENT EXTRACTION OF URANIUM. K. Glenn Shaw and Ray S. Long (Dow Chemical Co., Pittsburg, Calif.). Chem. Eng. 64, No. 11, 251-6(1957) Nov.

Operation and cost information on solvent extraction of U by hydrometallurgical operations is given. Solvents, equipment, principles, and cost factors are included. (W.L.H.)

1303

GAMMA DENSITY CONTROLS EXTRACTION COLUMN. Bernard G. Ryle (National Lead Co. of Ohio, Cincinnati). Chem. Eng. Progr. 53, 551-5(1957) Nov.

Gamma absorption density gauging can monitor both the organic extract and the aqueous raffinate and can control column feed rates to maintain normal steady-state operation in a liquid-liquid uranium extraction process. (auth)

1304

ELECTROLYTIC SEPARATION OF METALLIC ISOTOPES. James H. Andrews, Ivan Ceresna, F. A. Rohrman, and William F. Utlaut (Univ. of Colorado, Boulder). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 49-52(1956).

By use of Ni^{63} as a radioactive tracer it was found possible with electrochemical techniques to enrich the concentration of this Ni in the cathodic deposit. Nickel 63 apparently behaves more like a noble metal than do the ordinary Ni isotopes. Attempts to enrich Cd, Ag, and U by similar electrolytic means have not been successful up to this time. Count-

ing techniques were employed to follow the Ni, Cd, and Ag electrolyses, and the mass spectrometer was used for the U isotopes. (auth)

1305

PYROPROCESSING METHODS FOR NUCLEAR REACTOR FUELS. J. R. Foltz, F. D. Rosen, and W. J. Gardner (North American Aviation, Inc., Canoga Park, Calif.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 117-22 (1956).

Some of the advantages of pyroprocessing fused salt and metallic spent fuels are reviewed, and the basic chemistry of several proposed processes is briefly discussed. Small-scale operations are described as an approach to approximating full-scale operations. Some of the types of problems encountered during small-scale operations and their solutions are developed. (auth)

1306

A CONCEPTUAL DESIGN AND COST STUDY FOR CHEMICALLY PROCESSING IRRADIATED REACTOR FUELS. Sidney M. Stoller (Vitro Corp. of America, New York). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 131-41 (1956).

A conceptual design study conducted to establish costs of construction and operation of a small-scale chemical-processing facility is reported. This facility is designed to operate as a centrally located plant, equipped to handle, as feed, fuel elements of different compositions and of different enrichments. Discussion of the costs, as well as the effect on cost of changes in individual process variables, is included. A description of the conceptual design, giving general principles to be followed in setting up design criteria for a commercial reprocessing facility of this type, including discussion of layout, process equipment, and auxiliary services, is included. (auth)

1307

THE SOLVENT EXTRACTION IN NUCLEAR TECHNOLOGY. R. De Leone. Energia nucleare (Milan) 4, 391-8 (1957) Oct. (In Italian)

A general survey on the solubility of inorganic salts in organic solvents is given and the solubility of transition metals salts in oxygenated solvents is emphasized. The features of uranyl and thorium nitrates purification, of the U-Th and Zr-Hf separations and of U recovery from leach liquors, by solvent extraction, are reported. (auth)

1308

MIXED BED ION EXCHANGE FOR THE REMOVAL OF RADIOACTIVITY. H. Gladys Swope (Argonne National Lab., Lemont, Ill.). J. Am. Water Works Assoc. 49, 1085-1102(1957) Aug.

Experimental work using mixed bed ion-exchange resins for removing old mixed fission products from tap water showed that the highest decontamination factors were obtained when the water was adjusted to pH 2.5 with nitric acid. This adjustment increased the anion content of the water and it is therefore recommended that a 3:1 ratio of anion to cation resin be used. Flow rate appears to be an important consideration in removing radioactivity and should not exceed 2 gpm per cubic foot of mixed resin. The capacity of a mixed bed exchanger for the removal of radioactivity is based on the amount of total dissolved solids in the feed. The lower the dissolved solids content the larger the throughput. (auth)

1309

ELECTROLYTIC EXTRACTION OF THORIUM FROM FUSED SALTS. Lothar Abraham, Edward L. Thellmann, and James L. Wyatt (Horizons, Inc., Cleveland, Ohio). J. Electrochem. Soc. 104, 724-6(1957) Dec.

High purity thorium metal powder has been produced by fused salt electrolysis of thorium chloride by a process readily adaptable to continuous production techniques. An electrolytic cell design based on a frozen-salt crucible design concept has been evolved. Heating of the salt bath was accomplished by graphite resistance heaters immersed in the bath. Metal quality, current efficiency, and other operating characteristics of the internally heated electrolytic cell compare favorably with those experienced in smaller scale, externally heated cells. (auth)

1310

ANION EXCHANGE BEHAVIOUR OF YTTRIUM. Nobufusa Saito and Tatsuya Sekine (Univ. of Tokyo). Nature 180, 753(1957) Oct. 12.

1311

LIQUID-LIQUID EXTRACTION. PART IX. A FURTHER STUDY OF INDIVIDUAL FILM COEFFICIENTS FOR A PACKED COLUMN. R. Gayler and H. R. C. Pratt (Atomic Energy Research Establishment, Harwell, Berks). Trans. Inst. Chem. Engrs. (London) 35, 267-72(1957) Aug.

The coefficients for the continuous (but not the dispersed) phase are reduced by longitudinal mixing, and a driving force correction factor must be introduced into the mass transfer expression for this phase to allow for the resulting reduction in driving force. (auth)

1312

LIQUID-LIQUID EXTRACTION. PART X. OVERALL MASS TRANSFER COEFFICIENTS ON AN AREA BASIS FOR THE EXTRACTION OF ACETONE IN PACKED COLUMNS. R. Gayler and H. R. C. Pratt (Atomic Energy Research Establishment, Harwell, Berks). Trans. Inst. Chem. Engrs. (London) 35, 273-91(1957) Aug.

1313

LIQUID-LIQUID EXTRACTION. PART XI. MASS TRANSFER DATA FOR THE EXTRACTION OF URANYL NITRATE IN A PACKED COLUMN. L. E. Smith, J. D. Thornton, and H. R. C. Pratt (Atomic Energy Research Establishment, Harwell, Berks). Trans. Inst. Chem. Engrs. (London) 35, 292-300(1957) Aug.

Mass transfer and hold-up data are presented for the transfer of uranyl nitrate between water and methyl isobutyl ketone in a 4 in. diam. column packed with 8.0 ft. of ½ in. Raschig rings. Four series of runs were carried out; in three the transfer was from the aqueous into the solvent phase using a range of aqueous phase inlet concentrations, and in one the transfer was in the opposite direction. (auth)

1314

INDUSTRIAL TREATMENT OF SOLUTIONS OF FISSION PRODUCTS—SEPARATION OF Cs^{137}. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/13. C. Fisher and A. Raggenbass. London, Pergamon Press, Ltd., 1957. 9p. (In French)

1315

THE EXTRACTION OF INDIVIDUAL FISSION PRODUCTS FROM CHEMICAL PROCESS WASTES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/16. K. Saddington. London, Pergamon Press, Ltd., 1957. 20p.

Methods are described which have been used in the U.K.A.E.A. for producing from fission product waste solutions radioactive sources of two different types: Intense sources (1,000-2,000 curies) of Cs^{137} for use in medicine, industry and as a research tool; smaller sources for chemical studies and research applications, of unusual isotopes,

such as Np^{237}, which have hitherto been available, if at all, only in milligram quantities. (auth)

1316

STUDY OF NIOBIUM AND TANTALUM COMPLEXES FOR SOLVENT-EXTRACTION SEPARATIONS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/50. E. Bruninx and J. W. Irvine, Jr. London, Pergamon Press, Ltd., 1957. 8p.

Carrier-free 10.1-day Nb^{32} and 112-day Ta^{182} of high specific activity were used to explore various possibilities for the extraction of Nb or Ta from aqueous solutions containing complexing agents into various organic solvents, and to determine conditions for good separation of Nb from Ta. Good extraction of Nb was obtained at pH 10 into nitrobenzene, amyl acetate, and bis(2-chloroethyl) ether with 5,7-dichloro-8-quinolinol dissolved in the organic solvent, the distribution ratio (organic/aqueous) being about 4. Ta did not extract. Studies were made on the extraction of Nb and Ta as chlorides from HCl solutions of various concentrations, using numerous solvents. In every case the extractability of Nb is much higher than Ta, in several cases by more than the factor 10^3. In all systems, the extractabilities rise rapidly with increasing HCl until miscibility is approached, giving for example values up to 53 for methylisobutyl ketone with 6.5 M HCl, and 6 for bis(2-chloroethyl) ether with 8.3 M HCl. The addition of 0.05 M $H_2C_2O_4$ improved the reproducibility without lowering greatly the distribution ratios for Nb. The distribution data give some information on the nature of the complexes and provide the basis for practical separation of these elements from others and one another. (auth)

Spectroscopy

Refer also to abstract 1155.

1317

SOLID-SAMPLE TECHNIQUES IN K-CAPTURE SPECTROSCOPY. DETERMINATION OF CHLORINE AND BROMINE. William Seaman, H. C. Lawrence, and H. C. Craig (American Cyanamid Co., Bound Brook, N. J.). Anal. Chem. 29, 1631-2(1957) Nov.

Method of K-capture spectroscopy has been modified to make it applicable to solid samples—especially those difficultly soluble in suitable solvents. One modification involves pressing sample into a disk in which the x rays are absorbed. Another uses suspension of solid sample in heavy mineral oil. (auth)

Syntheses

1318 LA-2145

Los Alamos Scientific Lab., N. Mex.

THE PREPARATION OF C^{14}-PYRIMETHAMINE. Arthur Murray, III. June 24, 1957. 9p. Contract W-7405-eng-36. $0.50(OTS).

The antimalarial drug pyrimethamine has been synthesized and labeled with C^{14} for use in studies on its metabolic fate in lower animals. The over-all yield was 58% based on barium carbonate-C^{14}. (auth)

1319 NP-6464

Burke Research Co., Van Dyke, Mich.

RESEARCH AND DEVELOPMENT OF HI-TEMPERATURE NUCLEAR RADIATION RESISTANT ELASTOMERS. Quarterly Progress Report No. 1 [for] July 1, 1957 to September 30, 1957. Pauls Davis, Urs F. Nager, Ralph E. Isley, and Morley T. Johnston. Oct. 8, 1957. 33p. Contract AF33(616)-5303.

A study is presented of the preparation of experimental elastomers and their behavior under exposure to gamma radiation of the order of 10^6 and 10^9r total absorbed dosage. The present work covers polymerization and vulcanization studies. (W.L.H.)

Tracer Applications

1320

THE APPLICATION OF RADIOACTIVE ISOTOPES FOR DEVELOPING NEW METHODS IN ANALYTICAL CHEMISTRY. ORGANIC COPRECIPITANTS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/46. V. I. Kuznetsov. London, Pergamon Press, Ltd., 1957. 17p.

Transuranic Elements and Compounds

1321 ANL-5796

Argonne National Lab., Lemont, Ill.

THE TRANSFER OF PLUTONIUM HEXAFLUORIDE IN THE VAPOR PHASE. M. D. Adams, R. K. Steunenberg, and R. C. Vogel. Oct. 1957. 14p. Contract W-31-109-eng-38. $0.50(OTS).

Plutonium hexafluoride is decomposed by heat, by its alpha radiation, and by reactions with most materials of construction. Laboratory experiments were performed to investigate means by which plutonium losses due to these reactions can be minimized during vapor-phase transfers of the compound. The experiments showed that plutonium hexafluoride vapor could be transferred satisfactorily through well fluorinated nickel equipment in a stream of fluorine or helium. The decomposition product of plutonium hexafluoride was refluorinated at 250°C by fluorine. (auth)

1322 CRDC-697

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ontario.

OXIDATION OF Pu(IV) TO Pu(VI) IN SOLUTIONS OF NITRIC ACID, ALUMINIUM NITRATES, SODIUM NITRATE, AND URANYL NITRATE. I. H. Crocker. May 1957. 57p. (AECL-488).

The effects of temperature, Pu concentration, HNO_3 concentration, and NO_3^- concentration on the oxidation of Pu^{4+} to Pu^{6+} have been studied. The rate of oxidation increases as temperature and Pu concentration increase, decreases as the HNO_3 concentration increases, and, in general, decreases as the NO_3^- concentration increases, particularly when the ion is supplied by a highly ionized nitrate salt, such as $NaNO_3$ or $Al(NO_3)_3$. $UO_2(NO_3)_2$, which is strongly complexed in HNO_3 solution, inhibits Pu^{6+} formation when present in high concentration, but enhances its formation when present in low concentration. Quantitative data were obtained over a range of acid–salt concentrations, that should enable prediction of the oxidation state of Pu in most process solutions. (auth)

1323 HW-44744

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ABSORPTION SPECTRA OF PLUTONIUM AND IMPURITY IONS IN NITRIC ACID SOLUTION. M. N. Myers. July 31, 1956. Decl. Sept. 16, 1957. 22p. Contract W-31-109-Eng-52. $0.50(OTS).

The absorption spectra for Pu(III), (IV), (VI), and the red Pu(IV)-peroxy complex were determined in HNO_3 solution. Extinction coefficients for the above species of Pu were measured. Temperature has little effect on the spectra, but variation of acidity causes shifting of absorption peaks and some changes in the extinction coefficients. The absorption spectra and extinction coefficients in the region 390 to 1200 mμ were measured for chromic, nickelous, manganous, calcium, lanthanum, aluminum, ferrous, ferric, and permanganate ions in HNO_3 solutions. In addition, the effects of nitrite, oxalic acid, sulfamic acid, hydrogen peroxide, and various HNO_3 concentrations on the extinction coefficients of some of these ions were determined. The chromic, nickelous, ferrous, and permanganate ions, and ferric ion with oxalic acid, have sufficiently high extinction coefficients to cause inaccuracies in valence determinations of Pu in solutions containing high concentrations of these ions, unless corrections are made. (auth)

1324

THE PHYSICAL PROPERTIES AND ALLOYING BEHAVIOUR OF PLUTONIUM METAL. M. B. Waldron (A.E.R.E., Harwell). Atomics 8, 383-6(1957) Oct.

The two most distinctive features of Pu metal are its radioactive toxicity and the diversity of allotropic forms that it exhibits. Information on its toxicity and the necessity for glove-box work is given. Data on the transformation temperatures, the six solid phases, and the electrical resistivity of Pu are tabulated. The volume changes in Pu metal during heating and cooling are graphed. Its alloying behavior is discussed and equilibrium diagrams for the Pu–Th and Pu–Fe systems are given. (M.H.R.)

Uranium and Uranium Compounds

1325 ORNL-2381

Oak Ridge National Lab., Tenn.

HIGH ENRICHMENT OF URANIUM-235. B. Harmatz, H. C. McCurdy, F. N. Case, and R. S. Livingston. Nov. 11, 1957. 26p. Contract W-7405-eng-26. $0.75(OTS).

This report summarizes the results from three programs for the production of highly enriched U^{235} by the electromagnetic process. Products and enrichments obtained are: (1) 80 grams of 99.9% U^{235}, (2) 1100 grams of 99.7% U^{235}, and (3) 8 grams of 99.994% U^{235}. These materials have been made available for use on Atomic Energy Commission projects. An analysis of certain features of the process is made for its possible use in the separation of mass fractions 233 and 235 from 232, 234, and 235. (auth)

1326

SOME METAL COMPLEXES OF GLYCINE PEPTIDES, HISTIDINE AND RELATED SUBSTANCES. Norman C. Li, Edward Doody, and James M. White (Duquesne Univ., Pittsburgh and Christian Brothers Coll., Memphis, Tenn.). J. Am. Chem. Soc. 79, 5859-63(1957) Nov. 20.

The formation constants of Cu^{2+}, Ni^{2+}, and uranyl complexes of glycylglycine, glycine amide, histidine, and histidine ester have been measured and compared. The predominant coördination sites of histidine toward Cu^{2+}, Ni^{2+}, and uranyl ions are probably the "pyridine" nitrogen of the imidazole group and the amino group. The rates of alkaline hydrolysis of histidine methyl ester have been determined in the presence and absence of metal ions and it was found that an increase in the stability of metal-ester complex is accompanied by an increase in the bimolecular rate constant. (auth)

1327

MANGANESE-54, URANIUM-233 AND COBALT-60 COMPLEXES OF SOME ORGANIC ACIDS. Norman C. Li, William M. Westfall, Arthur Lindenbaum, James M. White, and Jack Schubert (Argonne National Lab., Lemont, Ill. and Duquesne Univ., Pittsburgh). J. Am. Chem. Soc. 79, 5864-70(1957) Nov. 20.

By using Mn-54 with ion-exchange technique, we have determined the formation constants of manganous complexes of 20 organic acids at pH 7.2 to 7.3, u = 0.16. The effect of –OH, double bonds, configuration, and chelate ring size on complex stability is brought out by comparison of the formation constants of the 20 acids. Uranium-233 was used with ion-exchange and solvent-extraction methods for the study of uranyl complexes of bioxalate, glycolate, and serine. Cobalt-60 complexes of four organic acids were studied by ion-exchange and solvent-extraction techniques. Several of the complexes also have been studied by pH method. An important assumption in the use of ion-exchange method for complex study is that the complex itself is not taken up by the cation exchanger. This has been demonstrated experimentally for the first time for some metal complexes by means of acetate labeled with tritium and with C^{14}. (auth)

1328

COÖRDINATION COMPOUNDS OF URANIUM WITH ORGANIC BASES IN AQUEOUS SOLUTION. Philip S. Gentile and Lawrence H. Talley (National Lead Co. of Ohio, Cincinnati). J. Am. Chem. Soc. 79, 5889-90(1957) Nov. 20.

The stoichiometry of complexes present in uranyl-urea, -thiourea, and -guanidine systems in aqueous solution has been determined by absorption spectra and Job's method of continuous variation. Only a combining ratio of 1:4 is evident in the uranyl-urea system at pH 3.5. Confirmation was obtained by isolation of the compound $UO_2(NO_3)_2 \cdot [CO(NH_2)_2]_4$. In the uranyl-thiourea system, at pH 3.5, a complex having a uranyl/thiourea combining ratio of 1:4 exists. A uranyl-guanidine complex with a 1:1 mole ratio was also found. (auth)

1329

THE URANIUM–SILICON EPSILON PHASE. S. Isserow (Nuclear Metals, Inc., Cambridge, Mass.). J. Metals 9, 1236-9(1957) Oct.

The properties of the U–Si ϵ phase have been investigated, with emphasis on the means of obtaining material resistant to corrosion in water. Evidence is presented that the corrosion resistance depends on the absence of phases other than ϵ and that the desired ϵ phase has a silicon content in the range of 3.9 to 4.0 wt. % rather than the 3.78 wt. % of stoichiometric U_3Si. It was necessary to develop an analytical method to overcome the apparently low silicon content found in this system under certain conditions. Attempts to fabricate this alloy were devoted primarily to coextrusion with Zircaloy-2. Extrusion constants are reported. (auth)

1330

PREPARATION OF URANIUM METAL BY FUSED SALT ELECTROLYSIS. G. Meister and W. C. Lilliendahl (Westinghouse Electric Corp., Bloomfield, N. J.). J. Metals 9, 1445-7(1957) Nov.

Uranium metal with a purity of about 99.9% was produced on a large scale by fused salt electrolysis with a material efficiency of about 90%. The material efficiency depends mainly on bath composition, electrolysis temperature, electrode smothering, and elutriation during washing of the powder. (auth)

1331

ABSORPTION SPECTRA OF THE COMPLEXES OF URANIUM (VI) WITH SOME β-DIKETONES. H. I. Feinstein

(U. S. Geological Survey, Washington). Microchem. J. 1, 237-44(1957).

The absorption spectra of the complexes of U^{6+} with four β-diketones were determined under various conditions of pH, concentration of uranium, and alcohol concentration. Under optimum conditions, the maximum molar absorptivity (31,200) is obtained using 2-furoyltrifluoroacetone. This compares with about 4,000 and 19,000 for the thiocyanate and dibenzoylmethane complexes, respectively. (auth)

1332

THE STUDY OF A NEW ELECTROLYTE SUPPORT FOR THE POLAROGRAPHIC DETERMINATION OF THE URANYL ION. Carlos J. Sambucetti and Aldo Gori. Publs. com. nac. energia atomica (Buenos Aires) Ser. quim. 1, No. 9, 91-113(1957). (In Spanish)

Waste Disposal

1333 AECU-3481

Texas. Univ., Austin. Sanitary Engineering Labs.

DEVELOPMENT OF DESIGN CRITERIA FOR WASTE STABILIZATION PONDS. Final Report. E. R. Hermann and E. F. Gloyna. Mar. 1, 1957. 169p. Contract AT(11-1)-220. $1.00(OTS).

Waste stabilization ponds have been used for many years as primary, secondary, and even tertiary sewage treatment devices; however, data for their economical and efficient design and operation have been lacking. The problem of developing rational design criteria for stabilization ponds was attacked on a broad basis; information from prior and contemporary investigators was collected and studied, factors thought to be important in stabilization pond processes were investigated in laboratory models and in outdoor pilot plants, and data reported since 1950 on pond installations at 188 communities throughout the State of Texas were compiled for statistical analysis. From these three sources of information along with certain theoretical considerations, empirical relations were formulated for the design and operation of a specific type of waste stabilization pond within a certain range of climatic conditions. The type of stabilization pond finally adopted for study was one in which the algal population density is low and bacterial stabilization of organic waste materials takes place largely under anaerobic conditions, since surface reaeration and photosynthetic oxygenation cannot satisfy the imposed biochemical oxygen demand in such systems. Design criteria are summarized. (auth)

1334 ORNL-2415

Oak Ridge National Lab., Tenn.

RADIOACTIVE WASTE DISPOSAL REPORT ON SEEPAGE PIT LIQUID WASTE—SHALE COLUMN EXPERIMENT. William J. Lacy. Nov. 12, 1957. 22p. Contract W-7405-eng-26. $0.75(OTS).

Seepage pits excavated from Conasauga shale have been used at ORNL for over five years as a method for disposing of large volumes of intermediate level radioactive liquid waste. Results are reported from a study of the adsorption capacity of the shale. From the results of laboratory studies an attempt was made to predict when the breakthrough of large quantities of radionuclides may occur, the order of occurrence for radionuclides present, and when the leaching action of rain and ground water may be expected to remove dangerous quantities of radioactivity from the saturated shale in the event the pits are abandoned as disposal units. (C.H.)

1335 WASH-742

Division of Reactor Development, AEC.

STATUS REPORT ON HANDLING AND DISPOSAL OF RADIOACTIVE WASTES IN THE AEC PROGRAM. Aug. 1957. 41p. $1.25(OTS).

The waste disposal standards of the AEC are briefly outlined. The present waste situation is discussed, with emphasis on high-level liquid wastes as the major waste problem in the AEC today as measured by dollars, curies of radioactivity, and potential health hazard. All the other kinds and categories of wastes, though significant, are several orders of magnitude less important. The other types of wastes discussed at length are low and intermediate level liquid wastes, solid wastes, and gaseous wastes. Estimates of future wastes are given. Present and future programs for waste disposal research and development are outlined. Future industrial participation in various actual waste handling and disposal operations appears feasible and desirable. The important requirement for continuing, long term responsibility for disposed radioactive wastes is emphasized. Industrial participation in packaging, transport, and disposal of solid wastes, dispersal of low level gaseous and liquid wastes, and high level waste disposal is also included. Finally, fission product recovery and utilization are reported. (L.T.W.)

1336

EFFLUENT TREATMENT. PRECIPITATION–ION EXCHANGE METHODS. K. G. Seedhouse (Industrial Group, Risley). Nuclear Eng. 2, 413-17(1957) Oct.

The increase in size and number of reactors in operation will accentuate the problem of fission product disposal. Work is described aimed at achieving greater decontamination factors than present large-scale methods at the lowest possible cost. (auth)

ENGINEERING

1337 AEC-tr-3075

A STUDY OF THE DEPENDENCE OF THE RESISTANCE OF METALS AND AMORPHOUS SUBSTANCES TO PLASTIC DEFORMATION ON THE SPEED OF DEFORMATION AND THE TEMPERATURE. L. D. Sokolov. Translated from Zhur. Tekh. Fiz. 17, 543-8(1947). 7p.

Experiments have been carried out on the static (speeds from 0.01 to 1 mm/sec) and dynamic (average speed 2000 mm/sec) crushing of cylinders of Pb, Sn, Zn, Al, Cu, Ni, pitch, plasticine, and glass at various temperatures. The actual stress curves obtained make it possible to determine the relation between the speed of deformation and the stress, for various testing temperatures. It was found that the effect of the speed on the actual stress becomes stronger with increasing temperature and lower melting points of metals. The speed has a particularly strong effect on the resistance of amorphous substances to deformation. (auth)

Heat Transfer and Fluid Flow

1338 AECU-3550

Oak Ridge Gaseous Diffusion Plant, Tenn.

LOW PRESSURE TRANSPORT THROUGH POROUS MEDIA. W. H. Eberhardt and R. B. Bernstein. Oct. 15, 1956. 20p. Contract [W-7405-eng-26]. (KLI-3883). $3.30(ph OTS); $2.40(mf OTS).

Knudsen flow in a homogeneous, isotropic porous medium is treated by a technique utilizing an integral equation to calculate the probability that a molecule starting from a solid surface within the medium will ultimately pass out of the medium. The permeability is then calculable from this probability function and the distribution of

initial collisions within the medium. The crux of the treatment lies in the kernel of the integral equation, $K(x,\xi)$, which has the physical significance of the probability density that a molecule which starts a free path from a surface somewhere in a slab centered around the coordinate x and normal to the direction of flow terminates its path in a similar slab centered at ξ. This kernel is expressed in terms of a function $p(\rho)$ which is the probability density that a molecule will exhibit a free path ρ inside the medium. This function then characterizes the medium completely. The problem is set up in a general way and detailed results are calculated for some analytically simple functions $p(\rho)$. The principal merit of the approach is that it reduces the description of the medium required for transport calculations to a statistically significant and measurable function and does not depend on a particular model. The connection between the shape of the function $p(\rho)$ and other properties of the medium such as void fraction and specific surface is not included in the treatment but requires a more specific model. However, a general expression for the average value of ρ is deduced in terms of these quantities. The permeability appears to depend largely on this average value of ρ; the particular shape of $p(\rho)$ appears to determine only a multiplicative factor of the order of unity. (auth)

1339 AECU-3579

Purdue Univ., Lafayette, Ind.

FREE CONVECTION HEAT TRANSFER TO HORIZONTAL CYLINDERS FROM AN ORDINARY FLUID CONTAINING A VOLUME HEAT SOURCE (thesis, January 1958). Jose Pineda de Guzman. 101p. Contract AT(11-1)-432. $16.80(ph OTS); $5.70(mf OTS).

Outside heat transfer coefficients for several horizontal tubes cooling an ordinary fluid containing a volume heat source by free convection were obtained experimentally. Water was used as the coolant, and a very dilute solution of HCl was the bulk fluid. The basic equipment included a Lucite test cell which contained the bulk fluid, Cu screen grids through which an alternating current was passed to generate a volume heat source in the bulk and several horizontal $\frac{1}{4}$ in. O.D. stainless steel tubes through which the coolant was pumped. Experiments were conducted using a single-tube, four-tube, and five-tube geometry. The heat transfer coefficients obtained were considered accurate within 8%. With single-tube cooling, the heat transfer coefficients were correlated by $Nu = 0.49 (Gr\ Pr)^{\frac{1}{4}}$. With four cooling tubes, the data were correlated by $Nu = 0.59 (Gr\ Pr)^{\frac{1}{4}}$, while with five cooling tubes the value of the coefficients in the correlation equation was $Nu = 0.64 (Gr\ Pr)^{\frac{1}{4}}$. (auth)

1340 CF-57-9-102

Oak Ridge National Lab., Tenn.

STATUS REPORT ON ThO_2 CAKING STUDIES. C. S. Morgan. Sept. 26, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Review of ThO_2 caking and sphere forming experiences in the 200 and 100 gpm loops shows that cakes and spheres always formed in the first 100 hours of the run or did not form at all, suggesting that processes in addition to oxide particle degradation were present. Many ThO_2 circulation tests in which no major difficulties were experienced suggest that preparation of oxides suitable for reactor use may have been accomplished, at least insofar as the caking problem is concerned. Further research is required to distinguish between oxide preparations. Evaluation of ThO_2 batches by "cake resuspension index" studies are described. A qualitative indication of the caking tendency of various batches of ThO_2 is given. Observations of ThO_2 sphere growth in stirred systems at atmospheric pressure indicate that added electrolytes have a strong influence. The results of ThO_2 cake disintegration tests are reviewed. A cake disintegration method has been used successfully twice to remove hard cake from inaccessible points in loops. The proposed program for caking studies in the 30 gpm loop, which is under construction, is outlined. The potential usefulness of several avenues for investigation of ThO_2 surface chemistry is indicated and the need for pursuing such investigations is pointed out. (auth)

1341 CF-57-10-122

Oak Ridge National Lab., Tenn.

AN INVESTIGATION OF THERMAL TRANSIENTS AT A SOLID–FLUID INTERFACE. J. E. Mott. Oct. 25, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

This report discusses analytical and experimental heat-transfer studies of cyclic temperature oscillations in a fluid medium and their effect on the temperature of an adjacent solid boundary. These studies are intended to aid in the analysis of thermal stress caused by cyclic temperature fluctuations. The results of experimental measurements of thermal amplitude attenuation for an effectively infinite wall are presented together with heat-transfer analyses for two cases with finite walls. (auth)

1342 HW-51998

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FABRICATION OF A TITANIUM TUBE HEAT EXCHANGER. R. W. Wirta. Aug. 20, 1957. 31p. Contract W-31-109-Eng-52. $1.00(OTS).

A prototype Ti tube heat exchanger, designed for use as a product concentrator in an acid stream, was fabricated. The development of fabrication techniques and the evaluation tests are described. (auth)

1343 NP-6458

General Electric Co. Light Military Electronics Equipment Dept., Schenectady, N. Y.

RESEARCH ON LIQUID METALS AS POWER TRANSMISSION FLUIDS. Quarterly Progress Report No. 4 [for] June to September 1957. R. C. Kumpitsch, J. Huthsteiner, and D. Lombardo. Sept. 1, 1957. 27p. Project 7-(1-7331). Contract AF33(616)-3698.

The General Electric Co. has provided a new facility in which to determine the feasibility of using sodium–potassium alloys, especially NaK 77, as a power transmission fluid for high temperature applications. The facility, complete with an integral disposal and clean-up area, provides a more efficient, clean, confined, and safe location in which to undertake this development. Operation in the new test area is scheduled for 16 September 1957. Initial tests conducted with the single cylinder NaK test pump revealed that modification and improvement of this equipment was necessary to insure consistent 3000 psi 1000°F operation. All design changes being made to the single piston pump tester are described in detail in the report. An investigation was conducted to determine the most suitable high temperature wear tester commercially available for preliminary screening of materials and for evaluating the lubricity effects of additives in NaK 77. Several of the wear testers being considered have been evaluated. This investigation has not been completed. The results to date are included in this report. Future effort will be directed toward getting the Single Piston NaK Pump tester into operation and the selection and purchase of the most desirable wear tester. (auth)

1344

CHARACTERISTIC EQUATIONS FOR REACTIVE FLOW. W. W. Wood (Los Alamos Scientific Lab., N. Mex.) and J. G. Kirkwood (Yale Univ., New Haven, Conn.). J. Chem. Phys. 27, 596(1957) Aug.

1345
A THEORETICAL STUDY OF STABILITY IN WATER FLOW THROUGH HEATED PASSAGES. H. Chilton (Atomic Energy Research Establishment, Harwell, Berks). J. Nuclear Energy 5, 273-84(1957).

Criteria defining the stability of forced water circulation through heated passages are introduced. A general method is derived for predicting stability criteria for a system with any form of variation of heat input with respect to passage length. A convenient method for calculating pressure loss is developed. Criteria and integrated functions are presented for the forms of heat-input distribution commonly encountered in reactor design, and their application is demonstrated in a worked example. (auth)

1346
EFFICIENCY OF A LONGITUDINAL FIN WITH VARIATION OF HEAT TRANSFER COEFFICIENT ALONG THE FIN. G. Melese. J. Nuclear Energy 5, 285-300(1957). (In French)

With a few simplifying assumptions, it is possible to compute the efficiency of longitudinal fins of practically arbitrary shape even when the heat-transfer coefficient is significantly greater at the tip than at the root of the fin. In such a case the efficiency is decreased compared to the case of a constant heat-transfer coefficient (equal to the mean value of the variable coefficient) and this decrease is comparatively larger for poor fin efficiencies. In principle, this decrease may reach 10 to 20% of the "classical" fin efficiency; but in practice, it may even be larger, when the fins are very close to each other, for instance. This case often happens in the cooling of nuclear power reactors by a gas, since the heat fluxes are important and the temperatures and coolant cross-section are limited. Nevertheless, the assumption of a constant coefficient is usually justified, since the fin efficiency is often only 10% or less smaller than the value found by the "classical" method (in most practical cases of rather efficient fins), in spite of the fact that experiments show the variation of the heat-transfer coefficient along the fin very seldom to be negligible. (auth)

1347
THE HEAT LOSS FROM NON-BOILING WATER AT HIGH HEAT FLUXES. V. V. Yakovlev. J. Nuclear Energy 5, 421-3(1957).

Some preliminary results are given here of experiments on heat loss from non-boiling water flowing turbulently in pipes, for large heat fluxes. (auth)

1348
PRESSURE DROP FOR PARALLEL FLOW THROUGH ROD BUNDLES. B. W. Le Tourneau, R. E. Grimble, and J. E. Zerbe (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Soc. Mech. Eng. 79, 1751-8(1957) Nov.

Friction factors for flow parallel to a rod bundle have been determined experimentally in a Reynolds-number range from approximately 5000 to 100,000. Three rod arrays were used; namely, a 1.20 pitch-to-rod diameter ratio on a square lattice, and a 1.12 pitch-to-rod diameter ratio on both square and equilateral triangular lattices. Entrance plus exit-loss coefficients, and joint loss coefficients between axially aligned rod bundles also were measured experimentally for tube-sheet end connections. For the square arrays, the effect of tube-sheet flow area on these loss coefficients was investigated. Results are presented in graphical form. (auth)

Materials Testing

Refer also to abstract 1758.

1349 ITR-1450
Federal Civil Defense Administration, Washington, D. C.
EVALUATION OF FCDA FAMILY SHELTER, MARK I, FOR PROTECTION AGAINST NUCLEAR WEAPONS. Preliminary Report. Neal FitzSimons. Aug. 1957. 25p. Project 30.3 [of] OPERATION PLUMBBOB.

An underground reinforced-concrete family shelter designed for six persons was tested at three anticipated nuclear blast overpressures: 30, 48, and 65 psi. The structures were calculated to sustain a 30-psi long-duration overpressure. Postshot examination of all shelters indicated there was little or no deflection in the reinforced-concrete members. Although the actual blast load was of short duration, the natural period for the structures was also short; therefore it is felt that the structures would withstand similar overpressures from long-duration blast loadings. The average attenuation factor for gamma radiation varied from 3000 to 4500. Permanent damage was confined to the exposed portions of the ventilation pipes, which were bent to a nearly horizontal position. The steel-plate door at the 65-psi level was dished inward about $1\frac{1}{4}$ in., but it opened and closed easily. (auth)

1350 ITR-1525
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DOME-STRUCTURE RESPONSE INSTRUMENTATION. Preliminary Report. G. H. Brittain and E. H. Scharres. July 1957. 29p. Project 30.5a [of] OPERATION PLUMBBOB.

Instrumentation is described which was devised to measure deflections and strains in reinforced concrete structures subjected to a blast field resulting from an atomic explosion. (C.H.)

1351 WADC-TR-57-92
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
EXPANSION CHARACTERISTICS OF MARLEX 20 AND MARLEX 50. Period Covered: May 1955 to June 1955. Hyman Marcus and Frank V. Zaleski. Mar. 13, 1957. 26p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: NUCLEAR RADIATION APPLICATIONS TO ENGINEERING MEASUREMENTS. (AD-130920).

A suitable technique was developed for volume dilatometry of plastic materials and the thermal behavior of two commercial linear polyethylene plastics, Marlex 20 and Marlex 50, was observed. (auth)

1352 AEC-tr-3079
EFFECT OF DEGREE OF DEFORMATION ON THE RELATION BETWEEN STRESS AND SPEED. L. D. Sokolov. Translated from Zhur. Tekh. Fiz. 18, 93-7(1948). 7p.

From experiments of the crushing of cylindrical specimens of various metals at various speeds of deformation it has been found that the speed coefficient depends on the degree of deformation, decreasing as the degree of deformation increases for refractory metals at 20°C, and increasing with increasing deformation for easily melted metals at 20°C and above, and also increasing for refractory metals at high temperatures. (auth)

1353 AEC-tr-3081
A SYSTEMATIC STUDY OF THE DEPENDENCES ON SPEED AND TEMPERATURE OF THE RESISTANCE TO DEFORMATION IN ONE-PHASE METALS. L. D. Sokolov. Translated from Doklady Akad. Nauk S.S.S.R. 70, 839-41 (1950). 4p.

A systematic extension of the experimental information on the plastic crushing of Pb, Sn, and Cu was carried out by tests made at intervals of 100°C from 20°C to temperatures near the melting points and for speeds of deformation from 6×10^{-4} to 120 sec^{-1} at intervals of 60 sec^{-1}. (J.E.D.)

1354 AEC-tr-3085
THE AERODYNAMIC BEARING. PART I. LAMINAR FLOW. G. Heinrich. Translated by R. Todd from Maschinenb. u. Wärmewirtsch. 7, 117-20(1952). 12p.

1355
THERMAL STRESSES, WITH APPLICATIONS TO AIRPLANES, MISSILES, TURBINES, AND NUCLEAR REACTORS. B. E. Gatewood. New York, McGraw-Hill Book Company, Inc., 1957. 245p. $7.50.

This volume touches on all phases of the structural-design problems related to thermal stresses. Included are the elastic and inelastic thermal stresses in various structures, the combined elastic and inelastic applied and thermal stresses, the allowable stresses for various materials and loading conditions, buckling, deflection, stiffness, fatigue, and shock and flutter effects of elevated temperature. (W.L.H.)

Pumps

1356 CF-57-10-24
Oak Ridge National Lab., Tenn.
PERFORMANCE TEST OF 220-v THREE-PHASE STATOR FOR USE WITH 5-gpm IN-PILE LOOP PUMP. A. Weitzberg and H. C. Savage. Oct. 4, 1957. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

1357 ORNL-2377
Oak Ridge National Lab., Tenn.
PULSE PUMPING: A MEANS FOR TRANSFER OF PULSE COLUMN FLUIDS. A. R. Irvine. Nov. 1, 1957. 28p. Contract W-7405-eng-26. $1.00(OTS).

A pulse pump, which uses the energy of the pulser to pump fluids to or from a pulsed solvent extraction column, was steady in operation, and results were reproducible. Performance was satisfactory with 2- and 12-in.-diam concatenated columns and with a 5-in.-diam straight column. (auth)

1358
SODIUM HYDROXIDE PUMP LOOPS. N. E. Miller and E. M. Simons (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 113-16 (1956).

The design and operation of small laboratory loops for investigating the influence of temperature, thermal gradient, and flow velocity on the corrosion of nickel by circulating sodium hydroxide are described. Results of corrosion are given for the temperature range of 900 to 1,500°F with thermal cycles from 70 to 200°F. Above 1,050°F with a practical thermal cycle of 100°F, the cool section of the system may become completely plugged by Ni deposition in a relatively short time. Present knowledge indicates that low maximum temperature and small thermal cycles are required for a reasonable lifetime of a NaOH-cooled reactor. (auth)

Vacuum Systems

1359
IONIZATION METHODS FOR DEVELOPING HIGH VACUUM. E. M. Reikhrudel and G. V. Smirnitskaya (Lomonosov Moscow State Univ.). Priroda 46, 87-91(1957) Sept. (In Russian)

Descriptions and designs are given for ion pumps with incandescent cathodes working on the gas ejection principle and with cold cathodes working on the gas absorption principle. (R.V.J.)

Waste Disposal

1360
DESIGN CONSIDERATIONS OF STORAGE TANKS FOR RADIOACTIVE WASTES. Edgar E. Wilson (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 153-7(1956).

The basic considerations involved in designing facilities for the long-term storage of radioactive wastes at the Savannah River Plant are presented. The storage facilities initially installed consist of 750,000-gal., 75-ft-diam. carbon steel tanks surrounded by concrete housings forming annuli to permit accumulation, detection, and removed of leakage. The tanks were built in a pit, waterproofed, and covered with earth. In a subsequent installation the tank size was increased to 1,000,000 gal., but the tops of the concrete housings were located slightly above finished grade and the bottoms of the steel tanks at the groundwater level. (auth)

1361
THE SAFE DISPOSAL OF RADIOACTIVE WASTES. H. J. Blythe. Energia nucleare (Milan) 4, 375-8(1957) Oct. (In Italian)

Systems for disposal of gaseous, liquid, and solid wastes are described. (M.H.R.)

MINERALOGY, METALLURGY, AND CERAMICS

1362 KAPL-M-BMS-3
Knolls Atomic Power Lab., Schenectady, N. Y.
FILAMENT TEST. B. M. Smith. July 30, 1957. 13p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Various concentrations of air in a He welding atmosphere vs. burn-out time of a tungsten filament were determined. Zircaloy test welds were made for corresponding points. (auth)

1363
REVIEW OF METAL LITERATURE. VOLUME 13, 1956. Marjorie R. Hyslop, ed. Cleveland, American Society for Metals, 1957. 867p.

An annotated survey of articles and technical papers appearing in the engineering, scientific, and industrial journals and books, here and abroad, is presented. This volume includes by chapters: general metallurgy; raw materials and ore preparation; nonferrous extraction and refining; ferrous reduction and refining; primary mechanical working; secondary mechanical working; powder metallurgy; heat treatment; joining; cleaning, coating and finishing; metallography, constitution, and primary structure; transformations and resulting structures; physical properties and test methods; mechanical properties and tests, deformation; corrosion; inspection and control; applications of metals in equipment; and materials. (W.L.H.)

Ceramics and Refractories

1364 AECU-3552
General Electric Co. Specialty Electronic Components Dept., Auburn, N. Y.
HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 3. D. A. Lupfer. 37p. Contract AT(30-1)-1963. $6.30(ph OTS); $3.00(mf OTS).

Development of a $BaTiO_3$–$SrTiO_3$ high energy storage ceramic capacitor continued. A large ceramic piece for the final test capacitor was successfully dried and fired and is undergoing contour machining. Materials development work resulted in samples of 98.9% of theoretical density. Samples have been measured up to 300 volts per mil stress and the dielectric constant continued to increase with increasing density. (For preceding period see AECU-3525.) (T.R.H.)

1365 LA-1846

Los Alamos Scientific Lab., N. Mex.

CASTING OF MAGNESIUM OXIDE IN AQUEOUS SLIPS. S. D. Stoddard, D. T. Doll, J. M. Taub, D. E. Nuckolls, B. L. Shroyer, J. J. Rosenthal, and T. I. Jones. Mar. 1957. 47p. Contract W-7405-eng-36. $1.25(OTS).

Fused magnesium oxide, after being subjected to wet ball milling and aging, may be suspended in water to form a slip. Deflocculation is obtained by addition of the proper amount of an acid. Both drain and solid castings have been produced successfully from these slips. The casting behavior of slips of varying grain size distribution and the properties of the resulting cast piece are given. Two firing techniques are described and several physical and mechanical properties of the ware resulting from these firing treatments are summarized. (auth)

1366

COPPER–SILICA AND COPPER–ALUMINA ALLOYS OF HIGH TEMPERATURE INTEREST. Klaus M. Zwilsky and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). J. Metals 9, 1197-1201(1957) Oct.

Utilizing relatively coarse Cu powders and several sizes of silica and alumina powders, alloys containing up to 10 vol. % of oxide were made. The alloys were prepared by mechanical mixing of powders, followed by cold hydrostatic pressing, sintering, and hot extrusion. Measurements were made of room temperature tensile properties, recrystallization temperature, creep rupture properties from 250 to 450°C, and resistivity. In addition, metallographic studies were made of the resultant structures. Of particular interest was the stability of the structure with respect to temperature, time, and stress. (auth)

Corrosion

1367 BMI-1179

Battelle Memorial Inst., Columbus, Ohio.

CORROSION OF HIGH-TEMPERATURE ALLOYS IN SULFUR-BEARING CRACKED-AMMONIA ATMOSPHERES. G. Lee Ericson, Walter J. Braun, Frederick W. Fink, and Robert S. Peoples. Apr. 17, 1957. 47p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

A representative selection of stainless alloys was exposed in sulfur-bearing cracked-ammonia atmospheres containing 43 vol. % water vapor. Experimentally controlled variables have included temperatures ranging from 1200 to 1800°F and S levels ranging from zero to 350 grains per 100 ft^3 of cracked ammonia. It has been found that high S levels do not result in any significant change in the corrosion behavior of materials evaluated. Increasing the temperature resulted in some modifications of both physical properties and scaling resistance; however, these changes are a function of the temperature and not an effect of S. (auth)

1368 CF-57-10-5

Oak Ridge National Lab., Tenn.

SUMMARY OF SPECIMEN CORROSION DATA FROM SLURRY BLANKET MOCK-UP RUN SM-3. S. A. Reed and E. L. Compere. Oct. 10, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Examination of corrosion specimens from the 948 hour slurry blanket mock-up Run SM-3 indicated generally low attack rates on type 347 stainless steel, titanium -75A, and Zircaloy-2. The upstream coupon of the array, of type 347 stainless steel, suffered moderate but more severe attack. Coupons of SA-212 grade B carbon steel were severely attacked. No stress corrosion cracking was noted on samples, placed in the pressurizer, of types 347 and AM 350 stainless steels, titanium aluminum–vanadium alloy, or Zircaloy-2. (auth)

1369 NP-6471

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE CORROSION PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. D. W. Stough. Sept. 13, 1957. 108p.

Presented as Lecture No. 23 for the New York Univ. Titanium Metallurgy Course, Sept. 9-13, 1957.

Data are presented on the corrosion resistance of Ti and Ti alloys to acids, alkaline media, inorganic salt solutions, gases, liquid metals, and organic compounds. (W.L.H.)

1370 TML-84

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE STRESS CORROSION AND PYROPHORIC BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. D. W. Stough, F. W. Fink, and R. S. Peoples. Sept. 15, 1957. 54p. Contract AF18(600)-1375.

The stress-corrosion behavior of Ti and Ti alloys is reviewed. Titanium is found to be susceptible to stress-corrosion cracking in at least two environments: red fuming HNO_3 and HCl. Molten Cd, a special case, causes stress cracking. Recently reported cracking at high temperatures may be stress-corrosion cracking resulting from NaCl on the surface of the metal. The reaction of Ti with anhydrous red fuming HNO_3 can result in a violent pyrophoric reaction or a sudden failure by stress-corrosion cracking. Further research is needed to establish the mechanism of stress-corrosion cracking of Ti and Ti alloys in these environments. There is some evidence that when there are small amounts of beta Ti at the grain boundaries, this constituent may be selectively attacked and lead to stress-corrosion cracking in HCl solutions o in red fuming HNO_3. Pyrophoric reactions were found to occur on Ti in red fuming HNO_3. It is believed that a similar reaction is the cause of a catastrophic failure of a Ti part in a uranyl sulfate solution. The pyrophoric reaction appears to be initiated by the formation of a finely divided powder on the surface of the metal. This has been identified as pure Ti. Apparently, the powder is formed by a selective corrosion attack on the metal. The data in this report were obtained from the published literature, reports of research, and discussion with various authorities in the field. (auth)

1371 WADC-TR-57-241(Pt. I)

Brooklyn. Polytechnic Inst.

DEVELOPMENT OF A CORROSION RESISTANT MAGNESIUM ALLOY. PART I. DEVELOPMENT OF MAGNESIUM ALLOYS FOR BETTER CORROSION RESISTANCE. [Period covered] May 1955 to September 1956. M. Balicki, C. D'Antonio, and A. Kravic. Mar. 22, 1957. 37p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-2917. (AD-131018).

A novel way for finding alloys of Mg with better corrosion resistance has been evolved. This scheme relies upon alloying Mg with elements which, owing to their lower surface tension, are expected to concentrate on the

surface and thus alter the corrosion behavior. From a number of elements having a lower surface tension than Mg the elements: Hg, Pb, Ge, In, Bi, Sn, Cd, and Ca have been added to it to form very pure, dilute, binary alloys. Since this was a feasibility study, insufficient data were obtained to allow a statistical analysis of results. The preliminary results obtained in general, however, indicate that Mg alloys containing Sn, Sb, Ge, Cd, and In compare favorably with pure Mg in the QQ-M-151A Salt Spray Test. (auth)

1372 WAPD-PWR-PMM-1062
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CORROSION OF EXPERIMENTAL ALUMINUM ALLOYS IN HIGH TEMPERATURE WATER. Report No. 8. I. Cohen. Apr. 6, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

The alloys tested in high-temperature water include X-2219 (Al–6 wt. % Cu), M-388(Al–1 wt. % Ni–0.5 wt. % Fe), and M-400 (Al–1 wt. % Ni–1 wt. % Fe). Static autoclave tests were made at 680°F in both saturated steam and water and at 600°F in water. Circulating autoclave tests were made at 680°F in water at pH values of 3.5, 4.0, 4.5, and 5.0. (J.E.D.)

1373 WAPD-PWR-PMM-1247
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CORROSION OF EXPERIMENTAL ALUMINUM ALLOYS IN HIGH TEMPERATURE WATER. Report No. 9. I. Cohen. Aug. 22, 1957. 14p. $3.30(ph OTS); $2.40 (mf OTS).

The alloys tested included x-2219 (Al–6 wt. % Cu), M-388 (Al–1 wt. % Ni–0.5 wt. % Fe), M-400 (Al–1 wt. % Ni–1 wt. % Fe), 192263 (Al–1.38 wt. % Ni–1.44 wt. % Fe), 1992264 (Al–2.64 wt. % Ni–0.35 wt. % Fe–0.35 wt. % Cr), and 192265 (Al–4.34 wt. % Ni–0.76 wt. % Cu–0.38 wt. % Fe). Static autoclave tests were made at 680°F in both saturated steam and water and at 600°F in water. Circulating autoclave tests were made at 680°F in neutral water with and without SbO_3 addition. Dynamic loop corrosion tests were run at 600°F in pH 8.5 to 9.4 water. Dynamic loop corrosion tests were run at 650°F in pH 7.0 water with 30 cc/kg of H_2. (J.E.D.)

1374 AEC-tr-3069
A STUDY OF DENUDING—SEVERAL CONSIDERATIONS CONCERNING THE DENUDING PROCESS OF AMALGAM FROM A GALVANIC CORROSIVE POINT OF VIEW. Fumio Hine. Translation of a Publication issued by Kyoto Univ. [1956]. 17p.

1375 AEC-tr-3070
CONSIDERATIONS ON DENUDING FROM THE STANDPOINT OF THE ELECTRIC POTENTIAL THEORY. Fumio Hine. Translation of a Publication issued by Kyoto Univ. Feb. 1957. 16p.

Various comparisons and studies were made both theoretically and experimentally on the factors affecting denuding from the standpoint of the electric potential theory, including the effect of amalgam surface-flow. It was pointed out that these various factors play an important role in the denuding reaction together with the electrochemical elements. (auth)

1376
CONTRIBUTION TO THE STUDY OF CORROSION OF ALUMINUM IN ALKALINE MEDIA. EFFECT OF THE CONCENTRATION. Helmy Makram. Compt. rend. 245, 1060-2(1957) Sept. 23. (In French)

Geology and Mineralogy

1377 BM-IC-7803
Bureau of Mines.
MINING METHODS AND COSTS—LA SAL MINING AND DEVELOPMENT CO., LA SAL URANIUM MINE, SAN JUAN COUNTY, UTAH. W. L. Dare and D. T. Delicate. Jan. 1957. 51p.

The La Sal ore body is in the Chinle (Triassic) formation. It is tabular and dips with the enclosing beds about 8° southwest. The ore body is generally 4 to 8 ft thick but in a few places is as much as 20 ft thick. It is being developed by a series of strike drifts and dip inclines, driven within the ore stratum on about 100-ft centers. A haulage level driven beneath the ore body is connected by raises to the upper workings. The waste rock that comprises the back of the ore body lacks the strength and rigidity to permit a standard room-and-pillar method of mining to be used. Therefore, experimental mining was begun in March 1956, and a method was developed that permits almost complete extraction of each block of ore, after which the back is induced to cave. It is a retreating room-and-pillar method, based on the removal of 18-ft panels, and has proved successful under conditions that are encountered in the La Sal mine. (auth)

1378 CEA-634
France. Commissariat à l'Énergie Atomique, Paris.
LES SCHISTES URANIFÈRES DU VERSANT ALSACIEN DES VOSGES MOYENNES. (The Uraniferous Schists of the Alsatian Slopes of the Middle Vosges Mountains). A. Grimbert and A. Carlier. 1957. 48p.

1379 RME-59
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THE DELTA MINE, SAN RAFAEL SWELL, EMERY COUNTY, UTAH. W. Scott Keys. Nov. 1954. 31p. $1.00(OTS).

The U deposit at the Delta mine differs from all others in the San Rafael Swell in size, stratigraphic position, and mineral assemblage. The ore, chiefly secondary carnotite and zippeite, is localized within a large sandstone lens of fluviatile origin. This lens is below the Moss Back member, the producing horizon elsewhere in the Swell, and above the base of the Chinle formation. Thirty-two minerals, 14 of which are U bearing, form mineralogic zones with varying composition. Carbonaceous plant debris probably precipitated or adsorbed most of the U from solution; many logs are found almost completely replaced by uraninite. The mineralogy of the deposit suggests an epigenetic origin and the mineral assemblage indicates that the U was probably derived from a hydrothermal source. Ground water is responsible for the formation of secondary U minerals. (auth)

1380 RME-3148
Minnesota. Univ., Minneapolis.
ANNUAL REPORT FOR APRIL 1, 1956 TO MARCH 31, 1957. John W. Gruner and James A. Knox. Apr. 1, 1957. 50p. Contract AT(30-1)-610.

Part I of this report is the "Mineralogy of the Ambrosia Lake Uranium Deposits in McKinley Co., N. Mex." The remarkable feature of these Ambrosia Lake ores is their great similarity or "sameness" with respect to mineralogy, petrography, and stratigraphy over a large area. Part II consists of additional experiments on the solubility of U and V compounds in bicarbonate solutions. More quantitative data than in last year's reports are supplied to round out knowledge on the behavior of U and V in sedimentary environments. Part III is an additional compilation of minerals identified from properties in Ariz., Colo., Mont., N. Mex., S. Dak., Tex., Utah, and Wyo. Only those properties and claims are listed which were sampled in 1956 or in which new minerals were discovered since publication of the last annual report of April 1, 1956. Part IV is a short experimental study to show the improbability of reduction and precipitation of uranous oxide,

UO_2, by pyrite and marcasite. The experiments gave negative results. For if ferrous iron could reduce UO_2^{++} at room temperature, much of the theorizing up to now would have been at fault. (auth)

1381

REMARKS ON THE URANIUM CONTENT OF THE WATERS OF THE SOUTHERN VOSGES MOUNTAINS. Georges Jurain. Compt. rend. 245, 1071-4(1957) Sept. 23. (In French)

1382

ALTERATION OF SANDSTONE AS A GUIDE TO URANIUM DEPOSITS AND THEIR ORIGIN, NORTHERN BLACK HILLS, SOUTH DAKOTA. R. C. Vickers. Econ. Geol. 52, 599-611(1957) Sept.-Oct.

Several uranium deposits are present in the Fall River sandstone of Early Cretaceous age on the northeast flank of the Black Hills, Butte County, South Dakota. The deposits are within a fine-grained, well-sorted, persistent basal sandstone unit that ranges in thickness from 2 to 18 feet and dips about 4° NE. Detailed mapping of about 2 square miles surrounding the deposits has shown that all the uranium occurrences and most of the areas of high radioactivity are where the color changes in the basal sandstone from reddish on the up-dip side of the occurrences to yellowish-gray or buff down-dip. Radioactivity measurements show that uranium is distributed almost continuously along the sinuous red-buff contact for more than 5 miles. Laboratory work indicates that the red color is caused by hematite resulting from the alteration of ferrous iron minerals and hydrous ferric oxides. The close association of the red-buff contact and the uranium deposits suggests that the two were formed by the same solutions. The uranium was probably deposited originally from ground water that moved down-dip and gradually changed from an oxidizing solution near the surface to a mildly reducing solution at depth. Concentrations of uranium have resulted from the localization of reducing conditions caused perhaps by structures superimposed on the regional dip, local thinning or decrease in permeability of the sandstone, or concentrations of pyritiferous carbonaceous material. The red alteration is probably the result of pre-Oligocene weathering that has extended downward in the more permeable beds about 200 feet below the ancient erosion surface. Oxidation of the primary uranium during the present weathering cycle has resulted in the formation of carnotite and possibly other secondary uranium minerals. (auth)

1383

ON THE OCCURRENCE OF URANIUM IN ANCIENT CONGLOMERATES. Charles F. Davidson (Univ. of St. Andrews, Scotland). Econ. Geol. 52, 668-93(1957) Sept.-Oct.

In recent discussions on the origin of the mineralization of the Witwatersrand and of Blind River, various departures from actualistic principles have been postulated by geologists of the placerist school in necessary support of their views. None of these hypotheses stands up to critical examination; and from consideration of the mineralogy and geochemistry of the banket reefs it is concluded that the mineralization is certainly not of alluvial origin. Claims that detrital uraninite can be recognized in mineragraphic studies lack due objectivity. Because of reworking of the uranium and the probable presence of old radiogenic lead, it is not yet possible to place any reliance on the apparent ages recorded for these banket ores. In speculation on the source of the pay-metals, it is suggested that the mineralization may be linked to periods of granitization late in the history of the Witwatersrand and Huronian geosynclines. (auth)

1384

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS AND RANK CORRELATION IN GEOCHEMISTRY. F. J. Flanagan (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 12, 315-22(1957).

The rank correlation coefficient, r_s, which involves less computation than the product-moment correlation coefficient, r, can be used to indicate the degree of relationship between two elements. The method is applicable in situations where the assumptions underlying normal distribution correlation theory may not be satisfied. Semi-quantitative spectrographic analyses which are reported as grouped or partly ranked data can be used to calculate rank correlations between elements. (auth)

1385

RADIOELECTRIC EQUIPMENT IN THE SEARCH FOR RADIOACTIVE ORES. J. Berbezier and P. Fabre. Revue Générale de l'Électricité 65, 467-70(1956). (In French)

The different methods used in prospecting the content in soil of those radioactive materials capable of forming a basis for production on the industrial scale of atomic energy are surveyed. After some basic generalities concerning the radiations from radioactive substances and those of their properties related to their detection, the authors review the types of apparatus currently used at various stages in the search for radioactive ores: Geiger-Mueller counters, scintillation counters, radioprospection instruments. They then describe the fields in which these instruments are used, particularly those of radioprospection, concerning surface prospection, the exploration of drill-holes of various depths, and mining. The article concludes with consideration on the analysis (determination of uranium content) and the sorting of ores according to their degree of radioactivity. (auth)

1386

YALE NATURAL RADIOCARBON MEASUREMENTS III. G. W. Barendsen, E. S. Deevey, and L. J. Gralenski (Yale Univ., New Haven, Conn.). Science 126, 908-19(1957) Nov. 1.

1387

SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF SANDSTONE-TYPE URANIUM DEPOSITS IN THE UNITED STATES. Robert E. Melin. U. S. Geol. Survey Bull. 1059-C. 1957. 120p. $0.35.

The annotations in this bibliography are of selected reports that relate to the geology of sandstone-type U deposits in the U. S. that were available on June 30, 1955. Also included are pertinent reports contributed to the International Conference on Peaceful Uses of Atomic Energy, August 1955, at Geneva, Switzerland; these reports were published in 1956 by the United Nations as volume 6, "Geology of uranium and thorium," and were among those published by the U. S. Geological Survey as Professional Paper 300, "Contributions to the geology of uranium and thorium by the United States Geological Survey and Atomic Energy Commission for the United Nations International Conference on Peaceful Uses of Atomic Energy, Geneva, Switzerland, 1955." The annotated reports have been selected on the basis of permanent value or interest. Because the Colorado Plateau is the center of the uranium mining industry in the United States, certain reports on the stratigraphy, structure, and general geology of parts of the Colorado Plateau have been included even though the discussions are not related directly to uranium deposits. The annotations are arranged alphabetically by author; if an author has written more than one report, the reports are listed chronologically. Co-authors are indexed alphabetically under "Authors." The annotations are numbered

surface and thus alter the corrosion behavior. From a number of elements having a lower surface tension than Mg the elements: Hg, Pb, Ge, In, Bi, Sn, Cd, and Ca have been added to it to form very pure, dilute, binary alloys. Since this was a feasibility study, insufficient data were obtained to allow a statistical analysis of results. The preliminary results obtained in general, however, indicate that Mg alloys containing Sn, Sb, Ge, Cd, and In compare favorably with pure Mg in the QQ-M-151A Salt Spray Test. (auth)

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1385

RADIOELECTRIC EQUIPMENT IN THE SEARCH FOR RADIOACTIVE ORES. J. Berbezier and P. Fabre. Revue Générale de l'Électricité 65, 467-70(1956). (In French)

The different methods used in prospecting the content in soil of those radioactive materials capable of forming a basis for production on the industrial scale of atomic energy are surveyed. After some basic generalities concerning the radiations from radioactive substances and those of their properties related to their detection, the authors review the types of apparatus currently used at various stages in the search for radioactive ores: Geiger-Mueller counters, scintillation counters, radioprospection instruments. They then describe the fields in which these instruments are used, particularly those of radioprospection, concerning surface prospection, the exploration of drill-holes of various depths, and mining. The article concludes with consideration on the analysis (determination of uranium content) and the sorting of ores according to their degree of radioactivity. (auth)

1386

YALE NATURAL RADIOCARBON MEASUREMENTS III. G. W. Barendsen, E. S. Deevey, and L. J. Gralenski (Yale Univ., New Haven, Conn.). Science 126, 908-19(1957) Nov. 1.

1387

SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF SANDSTONE-TYPE URANIUM DEPOSITS IN THE UNITED STATES. Robert E. Melin. U. S. Geol. Survey Bull. 1059-C. 1957. 120p. $0.35.

The annotations in this bibliography are of selected reports that relate to the geology of sandstone-type U deposits in the U. S. that were available on June 30, 1955. Also included are pertinent reports contributed to the International Conference on Peaceful Uses of Atomic Energy, August 1955, at Geneva, Switzerland; these reports were published in 1956 by the United Nations as volume 6, "Geology of uranium and thorium," and were among those published by the U. S. Geological Survey as Professional Paper 300, "Contributions to the geology of uranium and thorium by the United States Geological Survey and Atomic Energy Commission for the United Nations International Conference on Peaceful Uses of Atomic Energy, Geneva, Switzerland, 1955." The annotated reports have been selected on the basis of permanent value or interest. Because the Colorado Plateau is the center of the uranium mining industry in the United States, certain reports on the stratigraphy, structure, and general geology of parts of the Colorado Plateau have been included even though the discussions are not related directly to uranium deposits. The annotations are arranged alphabetically by author; if an author has written more than one report, the reports are listed chronologically. Co-authors are indexed alphabetically under "Authors." The annotations are numbered

consecutively for purposes of indexing. The alphabetical indexes are an author index; a subject index; a geographical index of localities mentioned in the reports; and an index of formations. The numbers after each entry in an index correspond to the reference number. The index map shows the location of most areas mentioned in the annotations. (auth)

1388

PRELIMINARY GEOLOGIC MAP OF PART OF THE TURTLE LAKE QUADRANGLE, LINCOLN AND STEVENS COUNTIES, WASHINGTON. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 135. George E. Becraft and Paul L. Weis. Washington, U. S. Geological Survey, 1957. $0.50.

Metals and Metallurgy

1389 AD-81894

Chicago Development Corp., Riverdale, Md.

RESEARCH ON ANODIC CHLORINATION OF TITANIUM–OXYGEN ALLOYS; RESEARCH ON FREE ENERGY OF DILUTION OF TITANIUM–OXYGEN ALLOYS. Final Report. R. S. Dean. Apr. 30, 1955. 34p. Project 037-068. Contracts Nonr-1140(00) and Nonr-1587(00).

In the anodic solution of Ti in a single compartment cell having an electrolyte of fused alkali and alkaline earth chlorides, only the dichloride is formed regardless of temperature or concentration. This is due to the reaction in the fused salt of alkali or alkaline earth metal solution formed at the cathode and titanium chloride to provide an equilibrium which corresponds to the equation; $TiCl_2 + Ca^0 \rightarrow CaCl_2 + Ti$. In this equilibrium the activity of the Ca^0 is not proportional to its concentration but to exp(–KC). As a result the equilibrium constant becomes: $C_{TiCl_2} \times e^{-KC} Ca^0 = K$ or $\log K' = \log C_{TiCl_2} = K' C_{Ca^0}$. Such an equilibrium is highly unusual because it requires that the concentration of both reactants increases together providing a sort of chain reaction which is stopped only when the salt becomes saturated with one of the components. For this reason quite unexpectedly large concentrations of $TiCl_2$ are found in melts saturated with alkali or alkaline card metal. It will be clear from these considerations that titanium can only be electrodeposited from dilute solutions of $TiCl_2$ which contain enough $TiCl_3$ to insure the absence of alkali metal solution at the cathode. Other deposition of titanium is strictly chemical. In a diaphragm cell a solution of alkali or alkaline earth metal is formed at the inert cathode, the potential of which is determined by the activity of the metal solution. This potential in a linear function of the metal concentration in accordance with the negative exponential relationship between activity and concentration in these metal salt systems. Anodic solution of titanium in a diaphragm cell forms a mixture of $TiCl_2$ and $TiCl_3$ depending on temperature and concentration. If the anode contains oxygen, this is not dissolved in the electrolyte but concentrated in the titanium. The free energy of this concentration is added to the free energy of ionic solution so that the potential of a diaphragm cell having saturated alkali metal at the cathode is higher for oxygen containing titanium. The relationship between cell potential for pure titanium and oxygen alloys enables the calculation of the free energy of oxygen dissolved in titanium. (auth)

1390 AD-119840

National Research Corp., Cambridge, Mass.

MANUFACTURING METHODS AND PILOT PRODUCTION OF TITANIUM ALLOY CASTINGS AND REPORTS. Interim Engineering Report No. 1. Phase II: Experimental, September 4 to December 4, [1956]. Richard H. Singleton and Maurice L. Torti. 16p. Contract AF33(600)-32801.

A total of nine 6 lb heats of pure Ti were poured from a 9-in. diameter tilt pour skull arc furnace into machined graphite molds in an attempt to obtain gas free castings. Pumping in the pressure range below 10 μ while molten and during freezing and subsequent remelting, as well as heating the mold, did not eliminate gas porosity. The vacuum operation of permanent W electrodes was shown to be possible although somewhat difficult. It is suggested that mold reaction or mold gas desorption is a major source of gas porosity. It is recommended that further studies continue to pursue the elimination of gas porosity with major emphasis put on mold material. (auth)

1391 AFOSR-TN-57-223

Johns Hopkins Univ., Baltimore.

EFFECT OF DISLOCATIONS AND GRAIN BOUNDARIES UPON THE DYNAMIC FORMATION OF SLIP BANDS IN ALUMINUM. Donald F. Haskell and Robert B. Pond. May 1957. 58p. Contract AF18(600)-1587. (AD-126521).

A free grain boundary is found to have no effect upon the velocity of propagation of slip bands in Al. The method is explained by which a free grain boundary may be obtained by means of a 180° rotation about the longitudinal axis of an Al single crystal. Also, it is determined that the average slip band velocity in a crystal is not affected by the average etch-pit density of the crystal; but that the slip velocity of propagation of nearest neighbor slip bands occurring in sequence is proportional to the average etch-pit density. The crystallography of the slip systems which activate in a bicrystal containing a free grain boundary is discussed, and a relation between crystallography and slip band velocity is proposed. It is found, also, that slip activation may occur at a free grain boundary. (auth)

1392 BM-IC-7784

Bureau of Mines.

MOLYBDENUM: A MATERIALS SURVEY. Wilmer McInnis. Sept. 1956. 86p.

The properties of Mo and its principal compounds and alloys are described. Exploration, mining, and metallurgical methods are discussed. Domestic and foreign resources and reserves are covered. An extended presentation of the structure of the industry, including major corporations, transportation service, processing facilities, interrelationships to other industries, pertinent laws and taxation policies, tariffs, Government controls, special labor problems, and history of wartime control experiences, are included. (auth)

1393 BM-IC-7791

Bureau of Mines.

TITANIUM: A MATERIALS SURVEY. Jesse A. Miller. Aug. 1956. 214p.

This volume covers the commodity Ti, the main emphasis being placed upon Ti metal and rutile. Ilmenite and Ti slag are also included, inasmuch as they are possible substitutes for rutile in some uses. The element Ti and its compounds are used in a variety of end products; therefore some of the chapters in this survey deal exclusively with Ti metal, while others include Ti minerals and various intermediate products. (auth)

1394 NAVORD-2055

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

RAPID-HEATING STRESS-RUPTURE PROPERTIES OF SEVERAL ENGINEERING ALLOYS. A. T. Robinson and J. D. Ramsdell. Sept. 2, 1953. 24p. (NOTS-749).

The report describes the equipment and technique useful for making rapid-heating-rate stress-rupture tests on metals. In addition data are presented on the rapid-

heating-rate strength of AISI 1015 steel, 18-8, and Inconel X at their respective service temperatures. (auth)

1395 NP-6462
Penn-Texas Corp., New York.
REPORT ON POWDER METALLURGY IN USSR. Henry H. Hausner. Sept. 1, 1957. (Contains translation: THE BASIC PROBLEMS OF POWDER METALLURGY IN THE LIGHT OF THE DECISIONS OF THE 19th CONGRESS OF THE COMMUNIST PARTY OF THE SOVIET UNION. V. S. Rakovski. Translated by George Kolokoltsoff). 21p.

Included are a discussion on the status of powder metallurgy in the USSR, abstracts of some powder metallurgy papers published in the USSR, translated table of contents of "Power Metallurgy—Kiev, 1955", and translated table of contents of "Powder Metallurgy—Jaroslav, 1956". (W.L.H.)

1396 NP-6466
Battelle Memorial Inst., Columbus, Ohio.
RESEARCH AND DEVELOPMENT OF PROCEDURES FOR THE JOINING OF SIMILAR AND DISSIMILAR HEAT-RESISTING ALLOYS BY ULTRASONIC WELDING. Progress Report [for] July 1, 1957 to September 30, 1957. N. E. Weare, R. E. Monroe, J. N. Antonevich, and D. C. Martin. Sept. 30, 1957. 11p. Contract AF33(616)-5342.

An experimental plan was drawn up to study the ultrasonic welding process and determine the properties of joints in selected combinations of materials for use at elevated temperatures. Materials for this study have been ordered and many are on hand for the experimental program. An ultrasonic welding unit was assembled and instrumented to investigate the mechanism of ultrasonic welding and to establish specifications for welding materials with ultrasonic energy. Preliminary experiments conducted to check the operation of the welding unit indicated that heating of the interface due to friction between the surfaces during the application of ultrasonic energy may be the predominant factor causing bonding in ultrasonic welds. (auth)

1397 NP-6470
Alabama. Univ., Tuscaloosa. Bureau of Engineering Research.
COMPARISON OF THERMAL FATIGUE WITH MECHANICAL FATIGUE CYCLING. Final Report [for] September 1, 1954—September 1, 1957. Harry Majors, Jr. Sept. 1957. 85p. Contract DA-01-009-ORD-396 and DA-01-009-ORD-454.

1398 NP-6473
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
HYDROGEN IN TITANIUM AND ITS ALLOYS. R. I. Jaffee. Sept. 30, 1957. 23p.

Presented as Lecture No. 8 for the New York Univ. Titanium Metallurgy Course, Sept. 9-13, 1957.

The effect of H_2 in Ti and Ti alloys with respect to mechanical properties is described. (W.L.H.)

1399 RDB(C)/TM-215
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
MECHANICAL PROPERTIES OF MAGNESIUM ALLOYS IN THE RANGE 350°C TO 500°C. A. Cowan and F. P. Ellen. June 3, 1954. 17p.

1400 RDB(C)/TM-227
Gt. Brit. Culcheth Lab., Culcheth, Lancs, England.
THE COMPATIBILITY OF MAGNESIUM ALLOYS WITH OTHER METALS. K. Q. Bagley and M. Finlan. Oct. 15, 1954. 78p. (TRDC/P-61).

Because of the projected use of Mg and its alloys in the fabrication of reactor containers and components, an investigation was initiated to determine Mg compatibility with other metals. The investigation includes the effect of oxide films, influence of alloying elements in Mg, and compatibility of Mg with alloys. (W.L.H.)

1401 WADC-TR-57-194(Pt. II)
Dow Chemical Co., Midland, Mich.
INVESTIGATION OF ALLOYS OF MAGNESIUM AND THEIR PROPERTIES. PART II. THERMAL AND ELECTRICAL PROPERTIES OF MAGNESIUM BASE ALLOYS. [Period covered] March 1956 to January 1957. H. Baker. May 1, 1957. 28p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-2337. (AD-131034).

The electrical resistivities for cast AZ31A & B, AZ63A, AZ81A, AZ91C, AZ92A, AM100A, EK30A, EK41A, EZ33A, HK31A, rolled HK31A and HM21XA, and cast HZ32A were determined at room temperature and in some cases up to 500°F. The values at 68°F ranged from 17.2 microhm/cm^3 for AM100A-T4 to 9.2 microhm/cm^3 for AZ31A & B-F & -T4 and from 7.7 microhm/cm^3 for cast HK31A-T6 to 5.0 microhm/cm^3 for rolled HM21XA-T8. At 500°F the values ranged from 11.6 microhm/cm^3 for EK41A-T6 to 9.1 microhm/cm^3 for HM21XA-T8 for the rare earth and Th containing alloys. Room temperature resistivity measurements on cast EM31 and EK31 ranged between 7.8 and 5.5 microhm/cm^3 for the -T6 and -T7 tempers, respectively. The temperature coefficients of electrical resistivity were fairly constant, ranging from 0.8 to 1.0 microhm/cm^3-°F. Calculations of thermal conductivity from electrical data are reported for AZ31A & B, AZ63A, AZ81A, AZ91C, AZ92A, AM100A, EK30A, EK41A, EZ33A, HK31A, HM21XA, and HZ32A. The temperature coefficients of thermal conductivity were all positive and decreased with increasing temperature. Enthalpy, specific heat, and heat of fusion were measured for AZ31B, HK31A, HM21XA, HM31XA, and ZK60A. The heat of fusion seemed to decrease with increasing alloy content from 82 cal/gm for HM21XA to 76 cal/gm for ZK60A. At temperatures around 500°F the specific heats of the alloys were about the same as that of pure Mg except the specific heat of AZ31B which was somewhat higher. (auth)

1402 WADC-TR-57-194(Pt. III)
Dow Chemical Co., Midland, Mich.
INVESTIGATION OF ALLOYS OF MAGNESIUM AND THEIR PROPERTIES. PART III. DEVELOPMENT OF PREFERRED ORIENTATION IN WROUGHT MAGNESIUM ALLOYS. [Period covered] March 1956 to January 1957. S. L. Couling. May 1, 1957. 32p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-2337. (AD-131035).

A polarized-light metallographic technique capable of supplying information on the orientation of individual grains in a polycrystalline Mg aggregate was developed and used as a tool in several orientation studies. The distribution of preferentially oriented grains in various extruded alloys was examined, and it was found that elongated clusters of grains of one orientation alternate with clusters of another orientation throughout much of the extrusion thickness. Inhomogeneous flow or "banding" has been found to be an important deformation mechanism during the cold rolling of certain alloys and the hot compression of alloy cylinders. The bands are believed to be formed by a fracture-glide mechanism. Banding may be operative during hot rolling with large reductions per pass and could account for the observed double peak in the preferred orientation of most rolled alloys. Polycrystalline material with a preferred orientation close to the ideal can be twinned almost completely by the application of a sufficient compressive stress parallel to the sheet

surface; on annealing, the heavily twinned metal recrystallizes in a preferred orientation markedly different from the initial ideal orientation. (auth)

1403 WADC-TR-57-241(Pt. II)
Brooklyn. Polytechnic Inst.
DEVELOPMENT OF A CORROSION RESISTANT MAGNESIUM ALLOY. PART II. SURFACE TENSION DATA OF ELEMENTS. [Period covered] May 1955 to September 1956. V. P. Siuta and M. Balicki. Mar. 22, 1957. 49p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-2917. (AD-131010).

Experimental and estimated values of surface tension of 75 elements have been gathered. This unique collection was of value in elucidating the Mg alloying program and should be of use to workers in other fields. Correlations for estimating surface tension values of elements have been scrutinized, augmented, and used. An extensive bibliography on the subject of surface tension is presented. (auth)

1404 WADC-TR-57-317
Battelle Memorial Inst., Columbus, Ohio.
THE DEVELOPMENT OF TESTING PROCEDURES AND THE EVALUATION OF COATINGS FOR TANTALUM, GRAPHITE, NICKEL, AND COPPER. [Period covered] October 15, 1955 to January 15, 1957. W. A. Spraker, A. E. Weller, R. E. Hess, J. L. Harp, and F. L. Bagby. July 10, 1957. 52p. Project title: THE DEVELOPMENT OF TESTING PROCEDURES AND THE EVALUATION OF COATINGS FOR TANTALUM, GRAPHITE, NICKEL, AND COPPER. Task title: PHYSICAL MECHANICAL AND THERMAL PROPERTIES OF ATLAS MATERIALS. Contract AF33(616)-3227. (AD-131070).

The results of a program to evaluate the resistance of a number of coatings for Cu, Ni, Ta, and graphite to erosion, oxidation, and thermal shock under high temperature service conditions are summarized. Specimens were tested in the throat of a hydrogen-oxygen rocket motor which could produce a maximum heat flux of approximately 3000 Btu/sec sq ft, and a maximum temperature of approximately 5500°F. The results indicate that several coatings have properties of promise. These coatings include Rokide A, Cr, and Cr-Ni coatings for Cu; Rokide A and Cr coatings for Ni; and a Rokide C coating for graphite. In general, flame sprayed and electrodeposited types of coatings appeared to be the most successful. None of the coatings for Ta that were tested were successful. The failure of coatings on Ta appears to be the result of oxidation of the Ta through the coatings; a successful Ta coating, if developed, should have a low porosity. Tests of coatings applied by vapor deposition indicated that these coatings have relatively poor adhesion and are subject to erosion. (auth)

1405 WAPD-NCE-4860
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
EVALUATION OF VACUUM CAST TRANSITION PIECES FOR PWR CORE I BLANKET. E. G. Schwartz and W. L. Frankhouser. June 5, 1957. 8p. $1.80(ph OTS); $1.80 (mf OTS).

The castings have been found satisfactory for core use in all respects and particularly in the matter of corrosion resistance. The inherent advantage of material conservation by casting has especial application to the fabrication of Zr and Zr alloy shapes due to high cost and scarcity of the material. In view of the compelling need for zirconium conservation and the considerable cost reduction, a wider use of zirconium alloy castings is strongly recommended. (auth)

1406 WAPD-TM-86
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
WEIGHT-SHAPE CONVERSION TABLES FOR ZIRCALOY-2. J. G. Goodwin. May 1956. 12p. Contract AT-11-1-GEN-14. $0.50(OTS).

1407 AEC-tr-3062
DIFFUSION COATING WITH SILICON. (Diffuzionnoe Silitsirovanie). N. S. Gorbunov and A. S. Akopdzhanyan. Translated from Zhur. Priklad. Khim. 29, 655-9(1956). 8p.

1408 AEC-tr-3072
ON THE CALCULATION OF METAL RESISTANCE TO PLASTIC DEFORMATION AS A FUNCTION OF DEFORMATION RATE AND TEMPERATURE. L. D. Sokolov. Translated from Doklady Akad. Nauk S.S.S.R. 67, 459-62(1949). 6p.

1409
THE MECHANISM OF SINTERING OF COPPER. B. H. Alexander and R. W. Balluffi (Sylvania Electric Co. Labs., Bayside, N. Y.). Acta Met. 5, 666-77(1957) Nov.

A study of the sintering of copper has been made using specimens prepared by winding 0.0128 or 0.00526 cm diam copper wires around copper spools. Changes in the size and shape of the voids between wires were observed as a function of sintering time and temperature. By these means it was possible to investigate both bonding and shrinkage in all stages of sintering. It is concluded that shrinkage in all stages is primarily due to the volume diffusion of atoms from grain boundary sources to the voids. During the initial stages of sintering bonding occurs by the above mechanism and also by volume diffusion between differently curved free surfaces of the voids. These conclusions are consistent with the following results: (1) shrinkage stops when the grain boundaries disappear; (2) shrinkage rates calculated on the basis of the volume diffusion mechanism agree reasonably well with observed rates; (3) the temperature dependence agrees with the volume diffusion mechanism; (4) the sintering scaling law for volume diffusion is found to hold for the wires of different sizes. (auth)

1410
THE WETTING OF SOLIDS BY LIQUID METALS. B. R. T. Frost (A.E.R.E., Harwell). Atomics 8, 387-90(1957) Oct.

The fundamentals of wetting are reviewed, and methods of measuring the wetting of metals by liquid Na, Bi, and Pb are discussed. Reactor problems concerned with wetting properties are summarized. These are concerned with corrosion, slurries or suspensions, and thermal and electrical conductivity. (M.H.R.)

1411
ON THE DIFFUSION AND LATTICE REORGANIZATION RELATIONS IN DISSOCIATION OF SATURATED SOLID SOLUTIONS IN ALLOYS. Yu. A. Bagaryatskii and Yu. D. Tyapkin (Central Research Inst. of Ferrous Metallurgy.) Doklady Akad. Nauk S.S.S.R. 115, 1111-14(1957) Aug. 11. (In Russian)

Data are given showing that during dissociation of Ti solid solutions in Ni or Ni–Cr the diffusion process precedes the reorganization in the lattice. Roentgenographic studies were made of Ni–Ti alloys with 11.8% Ti(14.1 at. %) and 13% Ti(~15 at. %), and the Ni–Cr–Ti alloy with 15.2% Cr and 7.1% Ti (16.6 and 8.4 at. %, respectively), and phase interrelations were analyzed. (R.V.J.)

1412
CLADDING ON CARBON STEEL OPENS NEW FIELDS TO TITANIUM. R. C. Bertossa (Stanford Research Inst., Menlo Park, Calif.). Iron Age 180, No. 18, 59-62(1957) Oct. 31.

The cladding of carbon steel with Ti using a Ag brazing alloy between the carbon steel and Ti is described. (W.L.H.)

1413

FORMATION OF INTERMETALLIC LAYERS IN DIFFUSION COUPLES. L. S. Castleman and L. L. Seigle (Sylvania Electric Products Inc., Bayside, N. Y.). J. Metals 9, 1173-4(1957) Oct.

Studies are presented on diffusion bonding in the Al–Ni system. It is well established that four intermetallic phases occur, which are designated $\beta(NiAl_3)$, $\gamma(Ni_2Al_3)$, $\delta(NiAl)$, and $\epsilon(Ni_3Al)$. Diffusional bonding between Al and Ni is limited to temperatures below the eutectic, which occurs at 640°C. (W.L.H.)

1414

INVESTIGATION OF THE NICKEL-RICH PORTION OF THE SYSTEM Ni–Zr. Emma Smith (Carnegie Inst. of Tech., Pittsburgh) and R. W. Guard (General Electric Co., Schenectady, N. Y.). J. Metals 9, 1189-90(1957) Oct.

1415

TRANSFORMATION KINETICS AND MECHANICAL PROPTIES OF Zr–Mo ALLOYS. R. F. Domagala, D. W. Levinson, and D. J. McPherson (Illinois Inst. of Tech., Chicago). J. Metals 9, 1191-6(1957) Oct.

Alloys containing 1.3, 3.3, 5.4, and 7.5% Mo were prepared using high-purity Mo and sponge Zr. Time-temperature-transformation curves were established for these alloys based on the resistivity vs. time of anneal curves of isothermally quenched rods. Tensile and impact bars of each alloy were heat treated by isothermal quench techniques as well as by quench and reheat treatments. These bars were then machined, tested, and the properties compared. Optimum properties could be developed in the 1.3% Mo alloy using the isothermal quench technique. The 3.3, 5.4, and 7.5% Mo alloys exhibited a brittle behavior irrespective of type of heat treatment. An ω or transition phase in the $\beta \rightarrow \alpha$ transformation was discovered which undoubtedly accounts for most of the brittleness observed. The ω phase has been tentatively indexed as tetragonal, $c/a = 1.45$. Mechanical properties of unalloyed sponge Zr are presented for comparison. (auth)

1416

SOME CHARACTERISTICS OF MARTENSITE TRANSFORMATION OF Cu–Al–Ni ALLOYS. C. W. Chen (Westinghouse Electric Corp., Pittsburgh). J. Metals 9, 1202-3 (1957) Oct.

Characteristics of martensite transformation on cooling and heating in a 14.5% Cu–1.5% Al–Ni alloy are presented. (W.L.H.)

1417

SAND CAST MAGNESIUM–RARE EARTH METAL–ZIRCONIUM ALLOYS. T. E. Leontis (Dow Chemical Co., Midland, Mich.) and D. H. Feisel (Carnegie Inst. of Tech., Pittsburgh). J. Metals 9, 1245-52(1957) Oct.

Addition of Zr to cast Mg–rare earth metal alloys results in a marked degree of grain refinement and a significant improvement in strength and ductility at temperatures up to 400°F. The strength properties and creep resistance of Mg–didymium–Zr alloys are markedly superior to those of Mg–Mischmetal–Zr alloys. Results of studies on alloys containing various proportions of Mischmetal and didymium, and cerium and didymium, are also presented. In general, both in Ce–didymium and Mischmetal–didymium alloys the strength properties increase with increasing didymium content. (auth)

1418

NATURE OF THE Ni–Cr SYSTEM. Robin O. Williams (Cincinnati Milling Machine Co., Ohio). J. Metals 9, 1257-60(1957) Oct.

It is shown that Cr-rich Ni alloys precipitate rapidly on cooling in more than one fashion. The solubility of Ni in Cr increases rapidly with temperature. No support was found for the recently proposed version of the Ni–Cr diagram. (auth)

1419

EFFECT OF HEAT TREATMENT ON THE HARDNESS AND MICROSTRUCTURE OF U–Ti ALLOYS. David L. Douglass and Lyle L. Marsh, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Metals 9, 1260-7(1957) Oct.

The hardness and microstructure of U–Ti alloys may be varied over wide ranges by suitable heat treatment. Quench-temper or isothermal treatments were particularly effective. The over-all response to heat treatment was dependent upon the phases present during solution treatment. Results are interpreted in terms of the phase diagram. (auth)

1420

NOTCH TENSILE PROPERTIES OF SELECTED TITANIUM ALLOYS. E. P. Klier (Syracuse Univ., N. Y.), and N. J. Feola (Curtiss-Wright Corp., Wood Ridge, N. J.). J. Metals 9, 1271-7(1957) Oct.

Selected α, α-β, and β titanium alloys have been tested in the notch-tension test. The base alloys were variously contaminated with carbon, nitrogen, and/or oxygen, and the notch sensitivity of the resultant materials was determined in the temperature interval $-320° \leqq T \leqq 75°F$. From these results contamination limits to produce embrittlement at the testing temperatures examined have been established. (auth)

1421

SOME INTERNAL FRICTION STUDIES IN COLUMBIUM. R. W. Powers and Margaret V. Doyle (General Electric Co., Schenectady, N. Y.). J. Metals 9, 1285-8(1957) Oct.

Carbon has been found to diffuse in columbium (niobium) at a slightly more rapid rate than nitrogen. At 1 cps, that internal friction peak which arises from the stress-induced ordering of carbon in columbium is found at 268°C while the nitrogen peak occurs at 285°C. The diffusion coefficients are: $D = 0.0046 \exp(-33{,}300/RT)$ for carbon in columbium and $D = 0.0072 \exp(-34{,}800/RT)$ for nitrogen in columbium. The carbon peak in columbium is very unstable, the height declining rapidly with time in contrast to the nitrogen peak. The ratio of the height of the nitrogen peak to the concentration of nitrogen in solid solution (expressed in wt pct) was found to be 0.33, in good agreement with previous work. The internal friction in high purity columbium was found to be a sensitive function of the strain amplitude at which the damping was measured. (auth)

1422

INVARIABLE TRANSFORMATIONS IN Al–Ti ALLOYS. N. N. Glagoleva, V. M. Glazov, and G. A. Korol'kov. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 8, 89-94 (1957) Aug. (In Russian)

Studies were made of the character of the invariable equilibrium and of the solubility of Ti in solid state Al at various temperatures. The thermal and microanalysis indicated the peritectic point at about 0.19 wt. % Ti, and the point of peritectic transformation at 665°C. The point of Ti saturation in Al was found at 0.26 to 0.28 wt. % Ti. A constitution diagram of Al–Ti alloys was developed on the basis of the studies. (R.V.J.)

1423

VISCOSITY OF MELTED TITANIUM. G. A. Grigor'ev, V. P. Elutin, and M. A. Maurakh. Izvest Akad. Nauk S.S.S.R. Ser. Tekh. Nauk No. 8, 95-101(1957) Aug. (In Russian)

1424

SOME PROPERTIES OF ZIRCONIUM–NIOBIUM ALLOYS. Yu. F. Bichkov, A. N. Rozanov, and D. M. Skorov. J. Nuclear Energy 5, 402-7(1957).

The constitution of zirconium-niobium alloys has been investigated and modifications to the existing equilibrium diagram are suggested. The mechanical properties of the alloys at room temperature have been determined and the hot-strength at temperatures of up to 750°C has been deduced from hardness measurements. Also, hardness has been measured after low-temperature ageing treatments. Measured results are correlated with the equilibrium diagram. The resistance of the alloys to oxidation in air has been determined in the temperature range 570 to 650°C. (auth)

1425

YOUNG'S MODULUS OF ZIRCONIUM–NIOBIUM ALLOYS. Yu. F. Bichkov, A. N. Rozanov, and D. M. Skorov. J. Nuclear Energy 5, 408-12(1957).

The results are given of measurements of the value of Young's modulus for zirconium-niobium alloys in vacuum at temperatures up to 950°C, and also at room temperature after various heat treatments. (auth)

1426

THE METALLURGY OF EBWR. Karl F. Smith (Argonne National Lab., Lemont, Ill.). Metal Progr. 72, No. 5, 79-83(1957) Nov.

Metallurgical problems involved in the EBWR and their solutions are discussed. The properties and fabrication problems of U which led to the use of U–Zr–Nb alloy in the fuel elements are described. Information on the steels used in the pressure vessel and control rods is included. (M.H.R.)

1427

PRESENT UTILIZATION OF TITANIUM. Metal Progr. 72, No. 5, 93-6(1957) Nov.

The advantages and varied applications of Ti for military and civilian purposes are summarized. (M.H.R.)

1428

A HOT SUBJECT: CASTING URANIUM. F. L. Cuthbert and W. E. Shaw (National Lead Co. of Ohio, Cincinnati). Modern Castings 30, No. 4, 32-3(1956) Oct.

1429

THORIUM. ITS PROPERTIES AND CHARACTERISTICS. I. P. Bell (Culcheth Labs., U.K.A.E.A.L.G.). Nuclear Eng. 2, 418-22(1957) Oct.

The physical, mechanical, and chemical properties of Th are presented. Also its compatibility with other materials is considered. (W.L.H.)

1430

BERYLLIUM. G. L. Miller (Murex, Ltd.). Nuclear Power 2, 438-40a(1957) Oct.

The fabrication of Be is summarized. Discussions are included on the consolidation of metal powder, the importance of particle size, corrosion resistance, health hazards, applications and future, Be as a structural material, weight saving, and the oxide as a nuclear moderator. A data sheet of the physical and mechanical properties of Be is included. (M.H.R.)

1431

HEAT CAPACITY OF α BRASSES BELOW 4.2°K. John A. Rayne (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 108, 22-5(1957) Oct. 1.

Heat capacity measurements below 4.2°K have been made on a series of α brasses with compositions ranging up to thirty-four weight percent Zn. The variation of density of electronic states as a function of Zn composition suggests that the Fermi surface in Cu deviates appreciably from sphericity. A comparison with theory and other experimental data concerning the shape of the Fermi surface in Cu is given. (auth)

1432

ZIRCONIUM FOR NUCLEAR REACTORS. I. E. Newnham (C.S.I.R.O., Melbourne). Research (London) 10, 424-8 (1957) Nov.

A method for preparing reactor grade Zr is outlined. The process consists of conversion of $ZrCl_4$ to $ZrCl_3$, condensation of unreduced $HfCl_4$ on the lid of the vessel, and transfer of sublimed $ZrCl_4$ to another vessel for Mg reduction. (T.R.H.)

1433

STUDY OF GRAIN BOUNDARY DIFFUSION IN METALS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/27. V. T. Borisov, V. M. Golikov, B. Y. Ljubov, and G. V. Shtsherbedinsky. London, Pergamon Press, Ltd., 1957. 17p.

A method is presented which allows to determine D and D_i from the data of just one experiment. Comparatively short diffusion annealing is sufficient for its application; besides, the method does not require any infraction of the specimen's entirety. Analysis of kinetic regularities of the diffusion element penetration into the polycrystal allows us to draw some conclusions concerning the theory of applying the autoradiographic method for measuring diffusion parameters. Equations are obtained describing the form of the diffusion front near grain boundaries; this allows to make quantitative evaluations of autoradiographic data. (auth)

1434

AN INVESTIGATION OF ELECTRIC TRANSPORT IN SOLID SOLUTIONS OF METALS USING RADIOACTIVE ISOTOPES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/29. I. N. Frantsevich. London, Pergamon Press, Ltd., 1957. 15p.

1435

ON THE STRUCTURE AND WEAR RESISTANCE OF CASE-HARDENED STEEL. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/32. L. S. Palatnik, I. M. Ljubarsky, and A. P. Ljubchenko. London, Pergamon Press, Ltd., 1957. 11p.

1436

THERMODYNAMIC STUDIES OF METALLURGICAL REACTIONS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/70. L. A. Schwarzman. London, Pergamon Press, Ltd., 1957. 14p.

Tracer Applications

1437

INVESTIGATION INTO CARBON ATOMS MOBILITY AND ATOMIC INTERACTION IN ALLOYS BY THE USE OF TRACER TECHNIQUE. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/28. P. L. Gruzin, Y. F. Babikova, Y. A. Polikarpov, and G. B. Fedorov. London, Pergamon Press, Ltd., 1957. 20p.

PHYSICS

1438 KAPL-M-WMP-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THERMAL CONDUCTIVITIES OF GASES, METALS, LIQUID METALS. W. M. Przybycien and D. W. Linde. Aug. 6, 1957. 29p. Contract [W-51-109-Eng-52]. $4.80 (ph OTS); $2.70(mf OTS).

Graphs on the thermal conductivities of gases (air, Ar, CO_2, CO, He, H_2, Kr, Ne, NO, N_2, O_2, and Xe), metals (Al, Be, Inconel X, Types 304, 347, and 446 stainless steel, Ti, U–Zr alloy, and Zircaloy-2), and liquid metals (Na and Na–K alloy) are shown. Densities of liquid Na and Na–K are included. (J.E.D.)

1439 AEC-tr-3082

HEATING OF THE STRATOSPHERE BY SOLAR ERUPTIONS. (Erwärmung der Stratosphäre durch Solare Eruptionen). Ferdinand Becker. Translated by M. I. Weinreich from Ann. Meteorol. 4, 487-92(1951). 12p.

1440 TIL/T-4733

THE PROBLEM OF PHASE TRANSFORMATIONS OF AMMONIUM NITRATE. (K Voprosu o Fazovykh Prevrashcheniyaka Nitrata Ammoniya). I. A. Leskovich. Translated from Zhur. Fiz. Khim. 28, 2255-7(1954). 6p.

1441

ABSOLUTE MEASUREMENT OF SPECIFIC SURFACES BY DIFFUSION OF X RAYS AT SMALL ANGLES. Simone Durif. J. chim. phys. 54, 633-6(1957) July–Aug. (In French)

The diffusion of x rays at small angles was used for determination of the specific surface of porous or granulated substances. The results are in good agreement with surface determinations by the BET adsorption method or, according to the case, the geometric surface defined by granulometry for samples of carbon black, amorphous silica, or ground quartz, with the condition that the heterogeneity of a scale not be too low. A preliminary application has been made to cokes and coals for which a systematic comparison of methods has proved interesting. (tr-auth)

1442

EXTENSION OF THE FUNCTIONAL THEORY TO PARTICLES OF SPIN ½. Florence Aeschlimann. J. phys. radium 18, 523-6(1957) Aug.-Sept. (In French)

Generalization of the functional theory of particles: (1) in the case of a particle under forces which do not derive from a potential in the non relativistic theory without spin; (2) in the case of a particle of spin ½ in the non relativistic theory; (3) in the case of a particle of spin ½ in special relativity is made. For a particle with spin, three cases are to be distinguished: (1) in the non relativistic theory, the non linear terms Q_1 and Q_2 derive from a complex scalar potential; in the relativistic theory, the non linear terms Q_i derive from a complex quadrivector; in this case there exists a linear relation between the Q_i ; (2) there is non linear relation between Q_i which are considered as the fundamental elements; the Q_i are to be developed on a basis of the matrices associated to the particles (Pauli's s-matrices in the non relativistic case, Dirac's matrices in the relativistic case). The development includes four terms in the non relativistic case and 6 to 16 (except 13) in the relativistic case; (3) we look upon the coefficients $\mathcal{C}$ of these developments as being the fundamental elements, and the Q_i as deriving from them. (auth)

1443

APPARATUS FOR OPTICAL STUDIES TO VERY HIGH PRESSURES. R. A. Fitch, T. E. Slykhouse, and H. G. Drickamer (Univ. of Illinois, Urbana). J. Opt. Soc. Amer. 47, 1015-17(1957)

An apparatus has been developed in two stages which permits optical studies to 200,000 atmospheres pressure. The use of NaCl windows permits studies in the near ultraviolet and in the infrared as well as in the visible. The design of the pressure cells and of a press suitable to fit in a spectrometer are described with essential dimensions. A calibration tested against Bridgman's data to 87,000 atmospheres is given. (auth)

1444

RADIATION FROM SLOTS ON DIELECTRIC-CLAD AND CORRUGATED CYLINDERS. James R. Wait and Alyce M. Conda. J. Research Natl. Bur. Standards 59, 307-16(1957) Nov.

An approximate formula is derived for the radiation pattern of an axially slotted cylinder with a thin dielectric coating. The accuracy of the formula is shown to be sufficient for practical purposes. Using a similar method, the pattern function for a slot on a corrugated cylinder is derived. Extensive numerical results are presented for both dielectric-clad and corrugated cylinders. (auth)

1445

A SURVEY OF THE SYSTEMATIC EVALUATION OF THE UNIVERSAL PHYSICAL CONSTANTS. R. T. Birge (Univ. of California, Berkeley). Nuovo cimento (10) 6, Suppl. No. 1, 39-67(1957).

The errors involved in published calculations and research on the physical constants are considered in detail. Among the errors mentioned are: reliance on authorities which actually are at fault; adopting values of constants independently of the value of other, often related constants; using a variety of values for the various auxiliary constants involved in a calculation; failure to reduce several measured quantities appearing in a certain formula to a common physical condition; the occasional use of an approximate formula, with no indication of the magnitude of the error introduced; the failure to state explicitly just what formula was used to calculate a certain quantity; lack of attempt to estimate the uncertainty involved in each phase of work; and the use of purely ad hoc and ill-advised methods of calculation. A plea is made for the intelligent use of the least squares method of calculation. The value of the electronic charge is discussed in detail since Millikan published his experimental results in sufficient detail to make extensive recalculations possible. Other topics discussed include the velocity of light, group and wave velocity, the Avogadro number, N, the fine structure constant and the representation of experimental uncertainty, and the general system of universal constants. (M.H.R.)

1446

PRESENT SOURCES OF PRECISE INFORMATION ON THE UNIVERSAL PHYSICAL CONSTANTS. J. W. M. DuMond (California Inst. of Tech., Pasadena). Nuovo cimento (10) 6, Suppl. No. 1, 68-109(1957).

The latest set of values for the universal physical constants are based on experimental data which fall into two groups. The input data for least squares adjustment are seven precisely determined experimental data which are so interrelated that they overdetermine four primary unknowns. These are: the Faraday constant by electrochemical methods; the conversion factor, $\Lambda = \lambda_g/\lambda_s$, from Siegbahn X-units to milliangstroms; the Siegbahn-Avogadro number, $N_s = N\Lambda^3$, by the x-ray-crystal-density method; γ_p, the gyromagnetic ratio of the proton; ω_c/ω_p, ratio of the cyclotron frequency of the proton to its magnetic resonance frequency; the proton magnetic moment in nuclear magnetons; ΔE_D fine structure separation in deuterium in frequency units; and the voltage-wavelength conversion factor, $(h/e)c^2\Lambda^{-1}$: short wavelength limit of the continuous x-ray spectrum. The input data treated as exact are quantities so precisely known relative to the first groups measurements,

and are involved with the latter in the least squares adjustment in such a fashion, that nothing is gained by treating them as adjustable. These are: Ma, atomic weights by method of nuclear reaction energies; R_∞, Rydberg constant for infinite mass (taking account of Lamb shift); μ_e/μ'_p, ratio of electron magnetic moment of proton magnetic moment; and recent measurements of the velocity of light. The four primary unknowns selected for the least-squares adjustment are: the Sommerfeld fine structure constant, α; the electronic charge, e; the Avogadro number, N; and the conversion constant, $\Lambda = \lambda_g/\lambda_s$, relating the two scales of wavelength. (M.H.R.)

1447

MATHEMATICAL ANALYSIS OF THE UNIVERSAL PHYSICAL CONSTANTS. E. R. Cohen (North American Aviation, Inc., Canoga Park, Calif.). Nuovo cimento (10) 6, Suppl. No. 1, 110-40(1957).

Topics discussed on experimental data are: a geometric interpretation, the criterion of least squares, standard errors and correlation coefficients, the standard errors of the residues of a least squares adjustment, analysis of data, and output values, recommended (1955) least squares adjustment. The 1955 adjustment is tabulated, based on the determination of four primary unknowns β, e, N, and Λ, by least-squares adjustment from seven independent sources of experimental input data combined with a number of auxiliary constants whose values are known so much more accurately than the aforementioned input data that they are negligible error contributors. (M.H.R.)

1448

PRESENT STATUS OF RESEARCH ON THE PHYSICAL CONSTANTS AT THE (UNITED STATES) NATIONAL BUREAU OF STANDARDS. R. D. Huntoon and A. G. McNish (National Bureau of Standards, Washington). Nuovo cimento (10) 6, Suppl. No. 1, 146-84(1957).

The accuracy with which our present standards of length, mass, and time can be measured is discussed. The difficulties in determining certain derived standards needed to proceed from primary standards to physical constants as standards are summarized. National Bureau of Standards measurements of such physical constants as the velocity of light, the gyromagnetic ratio of the proton, cyclotron resonance of the proton, fundamental constants derived with the aid of the resonance constants, and the faraday are described. It was concluded that length and time can be satisfactorily defined in terms of physical constants, but the inaccuracies in the measurement of mass cannot be overcome at the present time. It is suggested that it would be more advantageous to go directly to a four standard system by defining a fourth independent standard in terms of a physical constant which is precisely related to one of the electric quantities. (M.H.R.)

1449

AVOGADRO'S CONSTANT, LOSCHMIDT'S CONSTANT, AND THE MOLE. U. Stille. Nuovo cimento (10) 6, Suppl. No. 1, 185-213(1957).

Questions of nomenclature regarding the terms constant and number in connection with the names Avogadro and Loschmidt are cleared up corresponding to the definition and meaning of both constants. The problems involved in the precise evaluation of these constants and thus, of the mole, are discussed. (M.H.R.)

1450

A NEW DETERMINATION OF AVOGADRO'S NUMBER FROM LATTICE CONSTANT AND DENSITY OF SINGLE CRYSTALS. A. Smakula and J. Kalnajs (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (10) 6, Suppl. No. 1, 214-20(1957).

The previous values of Avogadro's number determined from the lattice constant and density of single crystals are listed. The differences in these values are noted, and possible errors are discussed. Among these are lattice-constants error, diffraction-angle error, material error, systematic errors, and density error. In this new determination, these crystals were used: Al, CaF_2, CsI, Ge, Si, SiO_2, TlCl, and TlBr. When the most unreliable values are disregarded, this value agrees with that of Birge within 0.00001. (M.H.R.)

1451

A NOTE ON THE DETERMINATION OF THE AVOGADRO NUMBER. N. W. H. Addink. Nuovo cimento (10) 6, Suppl. No. 1, 221-3(1957).

Problems involved in the determination of Avogadro's number by using x-ray data are discussed, with emphasis on determination of crystal density and the effects of imperfect crystals. (M.H.R.)

1452

SOME RECENT DETERMINATIONS OF THE VELOCITY OF LIGHT. E. Bergstrand (Swedish Survey Office, Stockholm). Nuovo cimento (10) 6, Suppl. No. 1, 224-31(1957).

Among the recent indirect methods reviewed for determining the velocity of light are the use of the cavity resonator for ultra short radio waves, microwave interferometry, and Shoran. The direct Kerr cell method is discussed at length. (M.H.R.)

1453

A REDETERMINATION OF THE VALUE OF THE FARADAY WITH THE IODINE COULOMETER. PROGRESS REPORT. D. A. Mac Innes and A. R. Pray (Rockefeller Inst. for Medical Research, New York). Nuovo cimento (10) 6, Suppl. No. 1, 232-41(1957).

The progress made in apparatus and methods needed for a redetermination of the faraday is reviewed. No values are proposed. (M.H.R.)

1454

A PRECISE MEASUREMENT OF THE MAGNETIC MOMENT OF THE PROTON. J. H. Sanders (Clarendon Lab., Oxford). Nuovo cimento (10) 6, Suppl. No. 1, 242-5(1957).

It has been previously pointed out that the ratio of the proton spin precession frequency ν_n in a magnetic field H to the proton cyclotron frequency ν_c in a magnetic field H' gives the magnetic moment of the proton μ_p in nuclear magnetons by the relation $\mu_p = \nu_n/\nu_c \cdot H'/H$. This principle was used to measure μ_p with greater precision than the two previous measurements, using a modification of the inverted cyclotron technique for the determination of ν_c. (M.H.R.)

1455

THE UNIVERSAL CONSTANTS OF PHYSICS. J. Palacios (Univ. of Madrid). Nuovo cimento (10) 6, Suppl. No. 1, 403-12(1957). (In Spanish)

1456

A NEW METHOD OF INVESTIGATING SOLID SURFACES BY MEANS OF RADIOACTIVE GASES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/35. C. Jech. London, Pergamon Press, Ltd., 1957. 8p.

Cosmic Radiation

1457

ON THE TRANSITION EFFECT OF EXTENSIVE AIR SHOWERS. A. Somogyi (Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 7, 189-97(1957).

The ratio of the number of primary particles in an extensive shower, which are capable of producing at least

one ionizing secondary beneath a given absorber, to the number of all ionizing particles (this ratio is called "transition factor") depends on the shower density. It follows further that the transition factor is a power function of the total number of particles contained in the shower with an exponent between 0 and 0.2 for thicknesses of lead absorber between 0 and 25 mm. This power function permits the determination of the average total number of particles contained in showers registered by the apparatus and the average distance of the shower axis from the apparatus. (auth)

1458

THE INTERACTION OF COSMIC RAY PROTONS AT ABOUT 10^{10} ev WITH Pb NUCLEI. L. T. Baradzeĭ, V. I. Rubtsov, et al. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 115, 685-8(1957) Aug. 1. (In Russian)

Investigations were performed at 9000 m elevation in a Wilson chamber placed in a magnetic field of 9200 oersted. To exclude interactions induced by mesons, 38 electron-nuclear showers generated in a Pb plate by single charged particles were selected. Measurements were taken of spatial particle track distributions, of charged particle pulses, and of their ionization ability. The estimate of particle direction was determined within ~2°. The ionizing ability was determined visually. Diagrams are given of the energy distribution of particles (electrons, π^+ mesons, and heavier particles) emitted during nuclear interactions in Pb. The energy values of primary particles, evaluated from the magnitude of the shower forming particle flux, and the multiplicity and angular distribution of shower particles, were from 10 to 13 Bev. Hence, it has been found in the interactions with Pb nucleus that the proton at about 10 Bev suffers a mean loss of about $\frac{1}{3}$ to $\frac{1}{2}$ of its energy, the charged and neutral π mesons carry away $\frac{1}{3}$ of the proton energy, and approximately the same amount is carried away by heavier particles. (R.V.J.)

1459

EFFECTS OF NON-PRIMARY COSMIC RADIATION ON THE NUMBER-ENERGY RELATION AND GEOMAGNETIC CORRELATIONS NEAR THE TOP OF THE ATMOSPHERE. K. A. Anderson (Univ. of Minnesota, Minneapolis). Nuovo cimento (10) 5, Suppl. No. 3, 389-416(1957).

Experimental results for flights at the geomagnetic latitudes 10° and 55° North in 1953 are presented. The data are presented in total flux as a function of atmospheric depth, pulse height distributions during ascent, and fast albedo and slow proton intensities at 0 and 60° zenith angles. The character of the splash albedo is illustrated by plots of its dependence on geomagnetic latitude, zenith and azimuthal angle, and on atmospheric depth. (M.H.R.)

1460

ANOMALOUS HEAVY PRIMARY CASCADES RECORDED ON VIKING 10 ROCKET FLIGHT. H. Yagoda (National Inst. of Health, Bethesda, Md.). Nuovo cimento (10) 6, 559-70(1957) Sept.

Emulsions flown to 136 miles on Viking 10 surrounded by only 2 $g \cdot cm^{-2}$ of superimposed metallic absorber have recorded two examples of heavy primaries which on collision with emulsion nuclei are not destroyed catastrophically. The heavily charged relativistic fragments emerging from the primary act produce secondary collisions after traversing distances that are small compared with the collision mean free path of the identified nuclei. The first event initiated by a particle of charge 14 ± 1 encompasses a total of 5 collisions which could originate by successive chance deviations from the geometric mean free path with a probability of $1.3 \cdot 10^{-5}$. The second cascade initiated by a carbon nucleus passes through two stages, and has its charge reduced to Z 3 before the latter escapes from the detector. Considerations of the relative frequency of different modes of fragmentation and geometric escape further reduce the probability of these events originating by chance and being detected. (auth)

1461

A CORRECTION TO PREVIOUSLY QUOTED COSMIC RAY FLUX VALUES. C. J. Waddington (H. H. Wills Physical Lab., Bristol). Nuovo cimento (10) 6, 748-50(1957) Sept.

A systematic error of somewhat more than 10% in nuclear emulsion measurements of cosmic ray flux is pointed out. This error arises from the failure to allow for the particles that enter the emulsions while they are rising to ceiling altitude during the exposure, and cause the fluxes to be overestimated. Corrections for this are proposed. (M.H.R.)

1462

HIGH-ALTITUDE COSMIC-RAY LATITUDE EFFECT FROM 51° TO 65°N GEOMAGNETIC LATITUDE. J. R. Winckler and K. A. Anderson (Univ. of Minnesota, Minneapolis). Phys. Rev. 108, 148-54(1957) Oct. 1.

A significant latitude effect of approximately 45% for the total vertical cosmic-ray flux has been found over the region 51°N to 65°N at 10 g/cm^2 atmosphere depth in 1955. No evidence for a primary "knee" can be found separated from the air-path saturation effect with latitude. Since there is evidence that the α spectrum is flat north of 55°, one concludes that the rigidity spectra of primary protons and α's differ over the corresponding rigidity region. Comparison of these data with telescope measurements of Pomerantz and McClure in 1950 does not show the anticorrelation with sunspot numbers found by Neher for ion-chamber measurements. The data are not in disagreement with latitude coordinates 4° higher suggested by studies of α particles, and, in fact, the observed latitude "saturation" effects are in better agreement with these new coordinates. A greatly increased counting rate was observed both at Minneapolis and Flin Flon, Manitoba, on August 26, 1955 at high altitude. (auth)

1463

ATMOSPHERIC SIGNALS CAUSED BY COSMIC-RAY SHOWERS. Robert R. Wilson (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 155-6(1957) Oct. 1.

It is suggested that large cosmic-ray showers can be detected by the electrical signal produced when the ionization of the shower nullifies the electric field of the earth. The signal should have two components, a very short but small signal due to the motion of free electrons, and a slow but possibly large component due to the motion of the ions. The energy of the signal is stored in the earth's electrical field until it is released by the ionization. An estimate is made of the size and duration of the signals which indicates that they may be detectable, especially in the case of the slow signal which may have a time of rise of the order of a fraction of a second. (auth.)

Crystallography and Crystal Structure

1464

APPLICATION OF GROUP THEORY TO CALCULATION OF SPIN-ORBIT COUPLING IN CRYSTALS. Francois Englert. Bull. classe sci. Acad. roy. Belg. 43, 272-83(1957). (In French)

The spin-orbit coupling perturbation in crystals is evaluated along the symmetry axis of the Brillouin zone by a systematic use of group theory. This method is applied to compute the valence band of Ge in the (100) direction of the Brillouin zone. (auth)

Electrical Discharge

Refer also to abstract 1504.

1465
TYPES OF PLASMA OSCILLATIONS IN A MAGNETIC FIELD. S. I. Braginskiĭ. Doklady Akad. Nauk S.S.S.R. 115, 475-8(1957) July 21. (In Russian)

A model of the configuration of charged ideal ionic and electron gases was used in the study of plasma oscillations in a wide range of frequencies for arbitrary direction of propagation and wave length. The investigation permitted the systemization of various types of oscillations and revealed some new data. (R.V.J.)

1466
FUSION EXPERIMENTS IN DEUTERIUM PLASMA. Seth Berglund, Robert Nilsson, Per Ohlin, Kai Siegbahn, Tage Sundström, and Sven Svennerstedt (Inst. of Physics, Uppsala, Sweden). Nuclear Instr. 1, 233-41(1957) Sept.

An experimental set up for studying fusion reactions and other features of a hot plasma is described. A low inductance condensor bank of 60 μF has been used and high current discharges in deuterium through straight tubes have been studied. The neutron production was found to be rather critically dependent on many factors. Two new phenomena have been observed: neutrons may appear already in the first pinch and furthermore, a high frequency oscillation in the plasma may occasionally be excited just after the pinch has been formed with a subsequent, strongly enhanced emission of neutrons. (auth)

1467
CRITERION FOR VACUUM SPARKING DESIGNED TO INCLUDE BOTH rf AND dc. W. D. Kilpatrick (Univ. of California, Berkeley). Rev. Sci. Instr. 28, 824-6(1957) Oct.

An empirical relation is presented that describes a boundary between no vacuum sparking and possible vacuum sparking. Metal electrodes and r-f and d-c voltages are used. The criterion applies to a range of surface gradient, voltage, gap, and frequency that extends over several orders of magnitude. Current due to field emission is considered necessary for sparking, but—in addition—energetic ions are required to initiate a cascade process that increases the emitted currents to the point of sparking. (auth)

1468
THE STABILITY OF A CYLINDRICAL GASEOUS CONDUCTOR IN A MAGNETIC FIELD. V. D. Shafranov. Soviet J. Atomic Energy No. 5, 709-13(1956).

Using a hydrodynamic approach, the criteria for stability of an idealized gaseous conductor in an external magnetic field are obtained. (auth)

Electrons

1469
RELATIVISTIC STABILIZED ELECTRON BEAM. G. I. Budker. Soviet J. Atomic Energy No. 5, 673-86(1956).

The physical principles underlying the formation of a relativistic stabilized electron beam are presented and questions connected with the stability of such a configuration are discussed. (auth)

Gases

1470 AEC-tr-3080
EMISSION OF ULTRA-VIOLET RADIATION IN GASES SUBJECTED TO THE INFLUENCE OF α-PARTICLES. Rene Audubert and Solange Lormeau. Translated from Compt. rend. 228, 318-20(1949). 3p.

A study is presented of the ultra-violet radiation emitted by different gases subjected to the influence of α particles. The investigation included air, O_2, N_2, H_2, and Ar, under pressures between 1 and 300 mm of Hg, at room temperature. Results obtained show that the ultra-violet intensities observed are proportional to the square root of the pressure for diatomic gases (O_2, N_2, air) and proportional to the pressure for a monatomic gases (Ne, Ar). (W.L.H.)

1471
SOME EXPERIMENTS WITH LIQUID ^{3}He–^{4}He MIXTURES IN NARROW SLITS. Derk Hendrik and Nicolaüs Wansink. Leyden, The National University, [1957]. 91p. (In Dutch)

The vapor-liquid equilibrium, osmotic pressure, thermodynamic properties, and flow properties of He^4–He^3 mixtures were investigated. (T.R.H.)

Instruments

1472 CF-57-9-96
Oak Ridge National Lab., Tenn.
SLURRY FLOW METERS AND DENSITY METERS FOR THE HOMOGENEOUS REACTOR. R. P. Wichner. Sept. 27, 1957. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Six types of instruments are being considered for the metering of flow and/or density in high temperature (300°C) and pressure (2000 psi) slurry flow systems. Three of these meters yield readings that depend only on the flow rate or the density, one (the Double Rotameter) yields two readings from which both the flow and the density may be determined while another (the venturi) yields a reading that depends on both the flow rate and the density and thus may be either a density-meter or a flowmeter depending on which variable is the unknown. The remaining instrument (the ultrasonic meter) may yield a signal dependent solely on the flowrate or the density depending on the physical setup. This memo briefly describes these instruments, listing their particular advantages, the difficulties that may arise in their use and the state of development of each. (auth)

1473 SCTM-237-57(14)
Sandia Corp., Albuquerque, N. Mex.
AN OSCILLOSCOPE CAMERA-POSITIONING SYSTEM. Paul L. Kerley and Vaughn D. Nogle. Sept. 10, 1957. 8p. Contract AT-(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A system is described which provides for a more economical use of the Polaroid-Land camera in instrumentation work by permitting up to 12 sweep exposures per print in place of the two exposures previously possible (auth)

1474
LEVEL CONTROL USING GAMMA RAYS. Werner Kraus: die atom wirtschaft 2, 335-6(1957) Oct. (In German)

1475
TOLERANCE LIMIT OF RESISTORS IN BINARY SCALING UNITS. B. M. Banerjee and Sneha Choudhury (Inst. of Nuclear Physics, Calcutta, India). Electronic Eng. 29, No. 351, 237-41(1957) May.

1476
INDUCTANCE-TYPE THERMOCOUPLE TESTER. Peter R. Morris (National Lead Co. of Ohio, Cincinnati). Instr. and Automation 29, 2217-19(1956) Nov.

Development of a portable battery-operated instrument capable of detecting a short-circuit four or more inches from the hot junction of a five-foot-long ther-

mocouple is described. A signal having a wavelength much greater than the electrical length of the thermocouple is used to measure thermocouple inductance. (auth)

1477

A DEVICE FOR THE PRECISION MEASUREMENT OF AN INHOMOGENOUS MAGNETIC FIELD. Gunnar Bäckström (Inst. of Physics, Uppsala). Nuclear Instr. 1, 253-8(1957) Sept.

A generator device has been constructed for measuring the field of a β spectrometer, having a gradient of 1% per cm and a field range 10 to 300 gauss. A sensitivity of $1:10^5$ has been obtained. (auth)

Isotopes

1478

SPECTRAL PROFILE AND REASON FOR THE WIDENING OF CERTAIN HIGHLY MONOCHROMATIC RADIATIONS OF Kr^{86}. Jean Terrien, Jean Hamon, and Toshiro Masui. Compt. rend. 245, 960-3(1957) Sept. 9. (In French)

The orange radiation $2p_{10}-5d_5$ of Kr^{86} can be produced with an intensity, a fineness, a spectral symmetry, and an almost total absence of perturbation which indicate it to be best suited as a fundamental standard of length. (tr-auth)

1479

ON THE PURITY OF MERCURY-198 PRODUCED BY NEUTRON IRRADIATION OF GOLD-197. J. R. McNally, Jr. (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 47, 1032-3(1957) Nov.

Calculations made under extremely pessimistic conditions for the allowable impurity of Hg^{199} in pile-produced Hg^{198}, to be used as a possible primary standard of length, show that the 99.6% or better Hg^{198} produced in the Oak Ridge National Laboratory graphite reactor satisfactorily meets these rigid design criteria. (auth)

1480

DISINTEGRATION OF Y^{90}. $0^+ \rightarrow 0^+$ TRANSITION IN Zr^{90}. TERM OF FIERZ. I. $0^+ \rightarrow 0^+$ TRANSITION IN Zr^{90}. T. Yuasa, J. Laberrigue-Frolow and L. Feuvrais. J. phys. radium 18, 498-504(1957) Aug.-Sept. (In French)

The results of our previous study of the disintegration of Y^{90} are recalled and completed in which the existence of a $0^+ \rightarrow 0^+$ transition of 1.734 Mev in Zr^{90} is indicated. The results are in good agreement with theory. The values of the strong parameter ρ^2 obtained by us and by other authors for $0^+ \rightarrow 0^+$ transitions are discussed. (auth)

1481

S^{32}/S^{34} ISOTOPIC COMPOSITION OF METEORITES AND OF THE EARTH. Presented at the International Conference on Radioisotopes in Scientific Research. Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/62. A. P. Vinogradov. London, Pergamon Press, Ltd., 1957. 9p.

Isotope Separation

1482 AERE-C/R-1847

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

GAS CHROMATOGRAPHIC SEPARATION OF HYDROGEN ISOTOPES. E. Glueckauf and G. P. Kitt. Feb. 9, 1956. 10p.

Complete purification of deuterium from deuterium-hydrogen mixtures has been achieved by passage of a 1:1 mixture through a column containing Pd black on asbestos, at room temperature. A column containing 20 g of Pd can deal with approximately 1 liter N.T.P. of mixture. The separation factor of T_2-H_2 is about 40% larger than that of D_2-H_2. This means that the separation is rather better, permitting a higher loading of the columns. (auth)

1483 HW-51820

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TABLES OF THE "V" FUNCTIONS. C. L. Childress and H. E. Hanthorn, comps. May 22, 1957. 191p. Contract W-31-109-Eng-52. $43.20(ph OTS); $16.50(mf OTS).

In calculations related to isotope separation, the concept of separative work is used as a measure of the plant capacity and energy input required to produce a given amount of isotope separated to a certain product specification. The separative work is given by $\Delta = PV(x_p) + WV(x_w) - FV(x_f)$. The function of concentration x denoted by $V(x) = (2x-1) \ln x/1-x$. A second function much used in isotope separation calculations is the derivation of V(x) with respect to x, $V'x = 2x-1/x(1-x) + 2 \ln x/1-x$. Values of V(x) and $-V'(x)$ are tabulated from x = 0 to x = 0.5. (M.H.R.)

1484

AN APPROACH TO THE PRODUCTION OF PHOSPHOROUS-33 IN MILLICURIE QUANTITIES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/12. E. G. T. Westermark, I. G. A. Fogelstrom-Fineman, and S. R. Forberg. London, Pergamon Press, Ltd., 1957. 13p.

The nuclear properties of P^{33} (25 days' half-life) are critically reviewed. At present the possibilities of production of P^{33} free from P^{32} are very limited. This situation is discussed with the following conclusion: Enrichment of S^{33} in the target material plus subsequent reactor neutron irradiation would facilitate a production in millicurie or larger quantities. Isotope enrichment methods for the heavy sulfur isotopes are therefore discussed. An ion exchange method is selected and its characteristic parameters, separation factor (K) and theoretical equivalent plate height (HETP) are discussed. A laboratory program is outlined which might lead to the production of P^{33} in sufficient quantities and purity. (auth)

1485

ELECTROMIGRATION OF RADIOACTIVE IONS IN FUSED SALTS. APPLICATION TO THE SEPARATION OF ISOTOPES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/214. H. J. Arnikar and M. Chemla. London, Pergamon Press, Ltd., 1957. 9p. (In French)

Mass Spectrography

1486 LA-2086

Los Alamos Scientific Lab., N. Mex.

ANALYSIS OF H-D-T MIXTURES BY MASS SPECTROMETRY. B. B. McInteer and R. M. Potter. June 1, 1954. 36p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

Analysis of H-D-T mixtures of H isotopes with the mass spectrometer was effected by "equilibrating" the purified mixture with a Tesla coil leak tester and using empirically determined equilibrium constants. Standard binary and ternary mixtures were prepared and analyzed. Agreement is obtained to the extent of random experimental errors. In the general middle range of ternary concentrations, the average accuracy was better than 0.4% composition. No systematic empirical corrections to the mass spectrometer were needed, so that the instrument proved to be absolute. In the analysis of unknowns, several internal checks on consistency of the results are available. (auth)

1487
A SURFACE IONIZATION MASS SPECTROMETER FOR PRODUCTION CONTROL. M. W. Echo and T. D. Morgan (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem. 29, 1593-5(1957) Nov.

A mass spectrometer using a surface ionization source has been constructed at the National Reactor Testing Station in Idaho. It is used for measurement of concentration and isotopic composition of uranium to provide criticality and accountability information on feed and product lines of the plant. (auth)

1488
MASS SPECTROMETRY IN THE ISOTOPIC ANALYSIS OF DEUTERIUM. B. Brigoli. Energia nucleare (Milan) 4, 411-19(1957) Oct. (In Italian)

The importance of D_2O in its industrial and research uses made necessary the perfection of measurement methods of isotopic concentration of compounds containing hydrogen and deuterium. The measurement method based on the separation of the molecular species constituting the mixtures under examination, by means of the mass spectrometer, is described. (auth)

1489
CONVERSION OF FIRST ORDER FOCUSING TO SECOND ORDER FOCUSING IN MAGNETIC SPECTROSCOPY WITH HOMOGENEOUS FIELDS. R. J. Walen. Nuclear Instr. 1, 242-50(1957) Sept. (In French)

The described magnetic lens, which corrects for the aberrations of a homogeneous magnetic field spectrograph, is inserted together with the defining slit of the beam of charged particles. This lens is essentially correct for a narrow gap such as used for focusing heavy particles, when axial aberration remains unimportant. (auth)

1490
AN A.G. CHANNEL WITH FOUR QUADRUPOLE MAGNETS. H. Schneider (National Physical Research Lab., C.S.I.R., Pretoria). Nuclear Instr. 1, 268-73(1957) Sept.

The known formalism of transformation matrices for the path of a charged particle in a magnetic quadrupole field is used to deduce the formula for focus, image and object distances for a single magnet and solid angles for a system. The magnets are treated as lenses and a focussing system is constructed. From the paths in this system, conditions for the magnetic fields are found, and these conditions are shown to correspond to a simple set of equations, which are solved graphically. The usefulness of this method was checked in an experimental set-up with monochromatic electrons from an electron-gun. The caustic was measured and the working conditions were found to be in agreement with the calculations. The approximations made in calculation and experiment are discussed. (auth)

1491
ADJUSTMENT OF DOUBLE-FOCUSING MASS SPECTROGRAPHS. F. Everling. Nuovo cimento (10) 6, Suppl. No. 1, 274-9(1957).

A schematic diagram of a mass spectrograph is given. In order to make complete adjustment possible, all 15 quantities which define the position of the slit and fields of any mass spectrograph must be ascertained. There are 4 geometric connections between these quantities, so that the geometry of the beam is fixed by exactly 11 quantities. Four equations are given as double focusing conditions for all masses. The adjustment of 4 quantities involved is described, and results are described as satisfactory. (M.H.R.)

1492
SPACE CHARGE NEUTRALIZATION IN THE IONIZING BEAM OF A MASS SPECTROMETER. R. H. Plumlee (RCA Labs., Princeton, N. J.). Rev. Sci. Instr. 28, 830-2 (1957) Oct.

A mass spectrometer ion source structure and its mode of operation are described by which the resolved ion current produced from a given gas concentration in the ionizing chamber can be made one to two orders of magnitude larger than is usually obtained in conventional mass spectrometer ion sources. This structure employs an ionizing chamber whose walls are electrically insulated from each other so they can operate at separate potentials which permit positive ions to be trapped in the ionizing beam. The resulting partial neutralization of the electronic space-charge allows the use of a higher current density ionizing beam and also increases the effective ionizing volume from which a stable ion current can be extracted. Inherently this mode of operation produces more fragmentation species because it increases the probability of several successive electron impacts on each particle. (auth)

1493
ION OPTICS OF THE MASS SPECTROMETER AND DETERMINATION OF THE SYSTEM IRON–CARBON–OXYGEN. Anne Johannes Hendrik Boerboom. Leyden, The National University, [1957]. 107p. (In Dutch)

The construction of two mass spectrometers of the 180° type with radius of curvature 20 cm and resolving power adjustable up to 1:600 is described. One novel feature permits greatly increased accuracy in the determination of isotopic abundances. The system Fe–C–O was studied up to 100 atm. (T.R.H.)

Mathematics

1494 ANL-5776
Argonne National Lab., Lemont, Ill. and North Carolina State Coll., Raleigh.
A TABLE OF WIGNER 9j COEFFICIENTS FOR INTEGRAL AND HALF-INTEGRAL VALUES OF THE PARAMETERS. Kenneth Smith and John W. Stevenson. Sept. 1957. 298p. Contract W-31-109-eng-38. $6.00(OTS).

The Wigner 9j coefficient $\begin{pmatrix} a & b & e \\ c & d & f \\ g & h & k \end{pmatrix}$, a function of nine variables, is defined for all positive integral and half-odd integral values of its arguments subject to the limitation that each of the six triads (abe), (cdf), (ghk), (acg), (bdh) and (efk) has an integral sum and satisfies a triangular inequality. (auth)

1495 ASAE-12
American Radiator and Standard Sanitary Corp. Atomic Energy Div., Redwood City, Calif.
A CROSS SECTION AVERAGING PROGRAM DESIGNED SPECIFICALLY TO PRODUCE INPUT TO THE PROGRAM ONE-SPACE-DIMENSIONAL MULTIGROUP FOR IBM 650. Roy C. Morrison and Edward J. Leshan. Mar. 1957. 11p.

1496 CF-57-4-56(Suppl.)
Oak Ridge National Lab., Tenn.
SUPPLEMENT TO: CURVE PLOTTING ROUTINE FOR THE ORACLE. M. P. Lietzke. Oct. 22, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

1497 IDO-16396
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MINIMUM RISK SPECIFICATION LIMITS. F. H. Tingey and J. A. Merrill. July 30, 1957. 45p. Contract AT(10-1)-205. $1.25(OTS).

A mathematical formulation is presented for establish-

ing rejection limits in a screening inspection system which minimizes the total risk associated with the misclassification of an item. The method is applied in conjunction with specifications for fuel elements for the Materials Testing Reactor and the Engineering Test Reactor. (C.H.)

1498 K-1358
Oak Ridge Gaseous Diffusion Plant, Tenn.
EXPLICIT NUMERICAL SOLUTION OF PARABOLIC DIFFERENTIAL EQUATIONS. D. W. Burton. Nov. 7, 1957. 28p. Contract W-7405-eng-26. $1.00(OTS).

The stability property of linear and non-linear explicit difference approximations to parabolic problems is discussed. The effect of the boundary condition on this stability property is brought out, and a way to effectively eliminate this effect is shown. Sufficient conditions for stability are obtained for both the linear and non-linear problems. It is shown that the stability of the linear portion of the non-linear problem is sufficient to guarantee the stability of the non-linear problem if the initial data are "small" enough. Results on round-off and truncation errors are also obtained. (auth)

1499 NYO-7971
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
ON SOME ITERATIVE METHODS FOR SOLVING ELLIPTIC DIFFERENCE EQUATIONS. Herbert B. Keller. Sept. 1, 1957. 48p. Contract AT(30-1)-1480. $7.80 (ph OTS); $3.30(mf OTS).

A family of iterative schemes is presented for the solution of systems of elliptic difference equations. The family is defined by a generalization of the usual notion of extrapolation or over-relaxation and includes many well known procedures. Theorems about the relationships between the eigenvalues of some of these schemes and their dependence upon the "extrapolation" parameters are proved. These results are used to define three subclasses, called complete image classes, of the general family of schemes. The complete image classes are such that each eigenvalue of any scheme in a class is a given algebraic function of at least one eigenvalue of any other scheme in the same class. Thus a knowledge of the eigenvalues of any scheme in a given complete image class enables the determination of the "best" scheme in that class. Some special equations are considered in which the eigenvalues of any scheme in the general family can be obtained in terms of the eigenvalues of two matrices. All of the results are applied to the case of the Laplace difference equations, as an example. Some well-known results on convergence of familiar schemes are immediate consequences. Analogous results are found for the less familiar "line" or block methods. (auth)

1500 UCRL-3927
California. Univ., Berkeley. Radiation Lab.
TCP THEOREM AND GREEN FUNCTIONS. Gerhart Luders. Sept. 10, 1957. 8p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

It is shown that use of the TCP theorem leads to the well-known simple structure of Green functions of two variables even if these variables are connected with different fields. For the case of Green functions of three variables, dependence only upon the squares of difference vectors (and not also upon θ functions) is demonstrated. The triangular inequalities in Minkowski space are treated in an appendix. (auth)

1501
ANALOGUE FOR SOLUTION OF HEAT-CONDUCTION PROBLEMS. W. R. Simmons (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 123-30(1956).

An electrical analog is described for the determination of two-dimensional equipotential patterns of Poissonian fields created by uniformly or nonuniformly distributed sources for steady state or transient heat-flow conditions. Heat transfer from a solid surface to a flowing fluid is simulated; however, physical properties and the surface heat transfer coefficient cannot be a function of time or temperature within the limits of the problem. Time-dependent source functions of the exponential type may be simulated. Potential measurements are converted to temperatures by use of a standard resistance. The accuracy of this technique is demonstrated by comparison of analog and analytical solutions for a number of steady state and transient heat-conduction problems. (auth)

1502
THE INTRODUCTION OF COLLECTIVE VARIABLES FOR THE DESCRIPTION OF ATOMIC NUCLEI. Maurice Jean and Jean Touchard. Compt. rend. 245, 1001-3(1957) Sept. 16. (In French)

Measuring Instruments and Techniques

Refer also to abstracts 1186, 1219, and 1273.

1503 AF-SAM-57-90
California. Univ., Los Angeles.
DEVELOPMENT OF A GERMANIUM CRYSTAL DOSIMETER. Benedict Cassen, Valerie Burkig, and W. A. Selle. Jan. 29, 1957. 9p.

The most satisfactory material found for use as a fast neutron dosimeter has been made by purifying and crystallizing 30 ohm-cm germanium three times with 3 zones of a zone melt furnace and adding 0.026 mg of indium per kilogram of germanium. Good crystal structure is important and requires a good seed crystal and zone widths between 1 and 1.5 inches. Close temperature control appears to be required to make reliable cold bath resistance measurements with the consequent accuracy of ΔC calculations. (auth)

1504 NAA-SR-1137(Pt. 3)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ABSOLUTE THERMAL NEUTRON DETERMINATION. PART 3. ABSOLUTE THERMAL NEUTRON FLUX. Moses A. Greenfield, Roscoe L. Koontz, and Alan A. Jarrett. Nov. 1, 1957. 13p. Contract AT-11-1-GEN-8. $0.50 (OTS).

A method for determining absolute thermal neutron flux is described. The method is based on a determination of the absolute specific disintegration rate in In foils in a windowless proportional counter with 2π geometry. By combining data on the absolute disintegration rate of activated In foils with appropriate corrections for neutron effects, the thermal flux is expressed in terms of σ_{β}, the known thermal absorption cross section of In^{115}. The method presented has an estimated error of less than 5%, which is a function of the accuracy with which it is possible to determine the various f factors for beta counting. However, it does not include a possible fixed error in the value of σ_{β}. The procedure described may be used by laboratories which do not have access to a standard graphite pile or to a standard neutron source. (auth)

1505 NP-6474
Stanford Univ., Calif. Applied Mathematics and Statistics Lab.
ON RENEWAL PROCESSES RELATED TO TYPE I AND TYPE II COUNTER MODELS—THE GENERAL COUNTER

PROBLEMS. Technical Report No. 37. Ronald Pyke. Oct. 21, 1957. 33p. Contract N6onr-25140.

A Type I counter is defined as one in which deadtime is produced only after an event has been registered, while Type II counter is one in which dead time is produced after each event has happened. Examples of Type I and Type II counters are the Geiger-Mueller counters and electron multipliers respectively. Several renewal processes related to the Type I and Type II counter models were defined and studied. The distribution and characteristic functions for the secondary (or output) process of the Type I counter model are obtained explicitly. Both the non-stationary and stationary probabilities of the state of the counter, (locked or unlocked), are derived. Integral equations determining the distribution and characteristic functions for the secondary process of the Type II counter model are obtained. Also it is shown that a more general model may be solved explicitly in terms of a corresponding Type II counter model. An example of this general model is given. Related with each model is a discrete renewal process which is also studied. (auth)

1506 NYO-2053

Johns Hopkins Univ., Baltimore.

THE STILBENE SCINTILLATION CRYSTAL AS A NEUTRON SPECTROMETER. C. D. Swartz, George E. Owen, and Oakes Ames. Aug. 1957. 60p. Contract AT(30-1)-2028. $9.30(ph OTS); $3.60(mf OTS).

One of the more efficient detectors which can be used as a neutron spectrometer (for neutron energies from 1 Mev to 20 Mev) is a single hydrogenous scintillator with associated photomultiplier tube and apparatus for pulse-height analysis. Neutrons entering such a scintillator produce recoil protons whose energies can be determined, in principle, from the observed pulse-height spectrum. The energy spectrum of the incident neutrons can then be determined from the energy spectrum of the protons. The elementary theory of this process is discussed in the following section. Various perturbing effects and background are considered in succeeding sections. Numerical data are presented in the form of tables and graphs for the particular case of stilbene, $C_{14}H_{12}$. (auth)

1507 RADC-TN-56-278

Rome Air Development Center, Griffis AFB, N. Y.

INVESTIGATION OF X-RADIATION HAZARDS, MEASUREMENTS, AND SHIELDING OF HIGH POWER RF TRANSMITTING TUBES. Philip Order. Jan. 1957. 30p. (AD-97713; PB-121955).

The permissible dosage for continuous exposure to x radiation and the methods of measuring such radiation near r-f generating equipment are investigated. It is found that various agencies concerned with the problem disagree about the value for permissible dosage; however, the value of the National Bureau of Standards is adopted. Certain radiation instruments are found to be affected by r-f, and those methods of measurement unaffected by r-f are described. (auth)

1508 USNRDL-TR-178

Naval Radiological Defense Lab., San Francisco.

A FIELD BETA-GAMMA DOSE-RATE METER. Frank A. Devlin. May 1957. 14p. Project NS 088-001.

A thin polyethylene chamber ionization detector has shown remarkable β flux sensitivity. It was found that by adding a removable β flux discriminator to the chamber it was practicable to differentiate between the β component and the γ component of the flux coming from a contaminant field. Laboratory experiments and field data substantiate the practicability of the system described. The γ energy dependence of the detector was found to be a maximum of 17% high relative to Co^{60}. (auth)

1509 AEC-tr-3071

DETECTION OF RADIOACTIVE CARBON BY THE SCINTILLATION METHOD. W. Hanle, K. Hengst, and H. Schneider. Translated from Z. Naturforsch. 7b, 633-4(1952). 5p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 7, as abstract No. 2067.

1510

STUDY OF THE SENSITIVITY OF AGFA K2 NUCLEAR TRACK EMULSION WITH THE ISOTOPE I^{131}. E. Bujdosó and L. Medveczky. Acta Phys. Acad. Sci. Hung. 7, 135-40 (1957). (In German)

Results showed the electron sensitivity of AGFA K2 nuclear track emulsion is 80 to 90 kev. The high sensitivity grains comprised only 2 to 4% of the total number of grains. (R.V.J.)

1511

THE WORK FUNCTION OF CATHODES FOR ELECTRONS AND THE PERFORMANCE CHARACTERISTICS OF GEIGER-MÜLLER COUNTING TUBES. Otto Orient. Acta Phys. Acad. Sci. Hung. 7, 199-206(1957).

Investigations were made concerning the relation between the work function of G-M counting tube cathodes and the performance characteristics of the tubes. The cathode materials investigated are Zn, Cd, Cu, and Ni. The results show that for counting tubes of identical geometry and filled to the same pressure, the plateau is longer and its slope lower for tubes with cathodes characterized by larger work functions. For identical overvoltages the electric charge liberated per count was proved to be the same in counting tubes with different cathodes. It follows that the other conditions being equal, the number of ions per discharge is independent of the material of the cathode. (auth)

1512

SIMPLE ABSOLUTE MEASUREMENT TECHNIQUE FOR BETA RADIOACTIVITY. APPLICATION TO NATURALLY RADIOACTIVE RUBIDIUM. W. F. Libby (Carnegie Inst. of Washington, D. C.). Anal. Chem. 29, 1566-70(1957) Nov.

Simple technique of measuring absolute radioactivity of solids and liquids by placing them in a cylindrical position around an ordinary Geiger counter gives results which agree with true absolute assays. Technique is used to measure half life of naturally radioactive rubidium. Method could be useful in introducing isotopes into chemistry classrooms. (auth)

1513

A PORTABLE SCINTILLOMETER WITH TRANSISTORS. G. Klima and H. Schneider. Atomkern Energie 2, 331-4 (1957) Aug.-Sept. (In German)

A picture, schematic diagrams, and test results are given. (M.H.R.)

1514

CONTROL OF RADIOACTIVE CONTAMINATIONS. A. Malvicini and C. Polvani. Energia nucleare (Milan) 4, 363-74(1957) Oct. (In Italian)

The methods for control of radioactive contaminants (solid, liquid, and gaseous) are summarized. Among the instruments diagramed are devices for the measurement of the radon in air, for absorption of radon from air and measuring it with a Geiger counter, for the electrostatic precipitation of atmospheric dust and an ionization chamber for the measurement of atmospheric tritium. (M.H.R.)

1515

A DEVIATION FROM WILKINSON'S THEORY OF DISCHARGE SPREAD IN GEIGER-COUNTERS. Satyapal Puri (Muslim Univ., Aligarh). Indian J. Phys. 31, 441-6(1957) Sept.

The measurements of the velocity of propagation of dis-

charge in Geiger counters have been carried out by the method of delayed coincidences. The measurements are interesting only in showing a divergence of results from the theory after the point where the charge generated becomes equal to the charge on the central wire. The spread due to electrons is considered to take a lead over the spread by virtue of ultraviolet photon content of the earlier avalanches after this point. (auth)

1516

IONIZATION CHAMBER WITH A GRID. S. A. Baranov, A. G. Zelenkov, and Yu, F. Rodionov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 913-7(1957) July. (In Russian)

The design and performance of an ionization chamber employing a grid are reported. The grid eliminates the influence of positive ions; thus, the amplitude of the electronic impulse does not depend on the direction of the particle escaping from the target. The installation permits interchanging four α-radioactive sources and preserves the physical conditions of the experiment. Pulses from the collector-electrode enter the amplifier then pass into the discriminator which cuts off a part of the pulse amplitude and amplifies the remaining part to the required magnitude. From the discriminator the pulses enter a multi-channelled differential amplitude analyzer. The installation proved of special value for the microquantitative analysis of α-active isotopes. Measurements were made of α-γ coincidences in Np^{232} decay. The α particles were recorded in the ionization chamber and γ rays in a scintillation spectrometer. The multi-channel analyzer received only the α-particle pulses which coincided with γ-rays of a particular energy. The method enables data to be obtained for the decay schemes of α-active, long-lived isotopes and the corresponding multipole transitions of the daughter nucleus. (R.V.J.)

1517

MEASURING METHOD OF NUCLEAR ACTIVITY IN K CAPTURE. M. Ya. Kuznetsova and V. N. Mekhedov. (Joint Inst. of Nuclear Research). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1020-4(1957) July. (In Russian)

A method developed for recording the isotopes undergoing K-capture effects and an improved electromagnetic analyzer used in the absolute count of K capture events are described. The simplicity of the installation and accurate identification of radiation are the best features of the apparatus. (R.V.J.)

1518

AMPLITUDES AND TRANSIENT CHARACTERISTICS OF A NEW PHOTOMULTIPLIER. G. S. Vil'dgrube, A. P. Zharkov, and E. D. Teterin. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1034-5(1957) July. (In Russian)

1519

A WELL SCINTILLATION COUNTER FOR IMPROVED VOLUME EFFICIENCY. William J. MacIntyre and James H. Christie (Highland View Hospital and Western Reserve Univ., Cleveland, Ohio). J. Lab. Clin. Med. 50, 653-6(1957) Oct.

1520

PRACTICAL USE OF AN IONISATION CHAMBER FOR THE DETERMINATION OF ABSOLUTE INTENSITY OF GAMMA RAYS. P. Savel. J. phys. radium 18, 518-19(1957) Aug.-Sept. (In French)

The efficiency of an ionization chamber for γ rays having been determined, a formula is given for the calculation of the absolute value of a γ ray source, upon the condition that the disintegration scheme is known. (auth)

1521

NEW NEUTRON DETECTOR BY FISSION IN A FLOWING GAS. L. Koch. J. Nuclear Energy 5, 357-61(1957). (In French)

With the instruments and methods described in this paper it is possible to measure, at any time, a flux of slow neutrons in presence of very intense fluxes of γ-rays: fission products are carried by a gas stream past a β-, γ-counter. The minimum measurable flux is of the order of a few thermal neutrons per cm^2 and per second. The power of a nuclear reactor can be easily followed; neutron density maps can be plotted very accurately as soon as fluxes are greater than 10^3/cm/s. Temperature resistance is excellent. (auth)

1522

THE USE OF A GAMMA-RAY POCKET DOSIMETER FOR FAST-NEUTRON DOSIMETRY. V. V. Bovin and A. I. Mosharov. J. Nuclear Energy 5, 427(1957).

1523

A WILSON CLOUD CHAMBER WITH TIME-MARKING OF PARTICLE TRACTS. D. Gabor and B. Hampton (Imperial Coll. of Science and Tech., London). Nature 180, 746-9 (1957) Oct. 12.

1524

COINCIDENCE ARRANGEMENT WITH HIGH TIME RESOLUTION USED TOGETHER WITH A 100-CHANNEL PULSE-HEIGHT ANALYZER. B. Johansson (Nobel Inst. of Physics, Stockholm, Sweden). Nuclear Instr. 1, 274-9(1957) Sept.

A time correcting circuit is described which compensates for timespread due to different pulse heights. A resolving time of $2\tau_0 = 9$ mμs is obtained with NaI(Tl) crystals for gamma energies above 50 kev. (auth)

1525

REDUCTION OF DISPERSION IN SCINTILLATION DETECTORS. J. F. Vervier and P. C. Macq. Nuclear Instr. 1, 282-8(1957) Sept. (In French)

The influence of resistance R and capacity C between the anode of the photomultiplier and mass, on time dispersion of pulses from a scintillation detector due to amplitude fluctuations, has been studied. Optimum conditions for minimizing that dispersion are discussed. Some experimental arrangements for reducing capacity C, and so time dispersion, are described. (auth)

1526

MEASUREMENT OF THE ENERGY OF ELECTRON PAIRS OF MORE THAN 1 Bev IN NUCLEAR EMULSIONS. R. Weill, M. Gailloud, and Ph. Rosselet. Nuovo cimento (10) 6, 413-24(1957) Sept. (In French)

In order to measure the projected angle ω of an electron pair, an absolute method was established which allows the diminishing of the uncertainties due to multiple scattering and grains dispersion. The measure of the track separation on several points from the pairs' summit allows the calculation $\Omega = \omega \div Z$ where Z is a gaussian variable of zero mean value attributed to noise level (multiple scattering and grain dispersion). This method can be used for electron pairs up to 20 Bev if it is admitted that this measure only has sense when the probability P for $\omega > Z$ is greater than 0.68; while with the usual method where the track separation is measured at only one point, energies up to 1.5 Bev can be determined. Ionization measurements on the initial tracks of high energy electron pairs give a relative measurement of their opening angles in space ω_e. The gap density g^*, was determined relative to the plateau on 6 electron pairs whose energies, greater than 10 Bev, have been measured by relative multiple scattering; g^* is a function of the distance to the summit and can be equated $g^* = 2 \cdot (1 - a \exp[-x/x_0])$. Two curves have been established, the one giving $1/x_0$ as function of ω_e, the other log $(1-0.5g^*)$ as function of Y_e the tracks' separation. Given

the above criterium ($P[\omega > Z] > 0.68$), energies over 10 Bev can be determined in this manner. The measured values of ionization agree qualitatively with those foreseen by the theory of Della Corte, taking into account dipole effect and geometrical considerations. The track separation was measured for 4 secondaries of a jet with an energy superior to 1000 Bev/nucleon and have noticed that the influence of spurious scattering is eliminated for horizontal separations and height differences not above 30 μm, and cell lengths up to 2 mm. (auth)

1527

HIGH SENSITIVITY TRANSISTOR PULSE TRIGGER CIRCUIT. E. Zaglio. Nuovo cimento (10) 6, 512-15(1957) Sept.

A high sensitivity current pulse discriminator is described. It consists of a germanium diode and a differential negative resistance of high stability consisting of a transistor amplifier with a positive feedback. The threshold can be set in the range of 5 to 50 μA, its stability being of the order of 1%. (auth)

1528

A ČERENKOV COUNTER AS HIGH ENERGY PHOTON SPECTROMETER. I. Filosofo (Univ. of Illinois, Urbana). Nuovo cimento (10) 6, 701-9(1957) Sept.

A Čerenkov counter designed as high energy γ spectrometer is described. Lead glass is used as a medium in which the shower from a γ is both produced and absorbed. The incident energy is measured by means of the Čerenkov light produced in the medium by the electrons of the shower. The counter has been calibrated with electrons of energies up to 275 Mev and has shown high efficiency, linear response with the energy and energy resolution from $\pm 28\%$ at 80 Mev to $\pm 17\%$ at 275 Mev. Possible improvements of this type of instrument are discussed. (auth)

1529

COUNTING RATE CURVES FOR GEIGER COUNTERS AND THEIR GEOMETRY. P. J. Grouse and H. D. Rathgeber (Univ. of Sydney, N.S.W.). Nuovo cimento (10) 6, 719-22 (1957) Sept.

The shape of the counting rate curve for a particular type of Geiger counter has been computed from purely geometrical considerations. Experiments designed to minimize non-geometrical effects support these calculations. General observations are made concerning the effect of design parameters upon counting curves for counters of all designs. (auth)

1530

COUNTING RATE OF COSMIC RAY COUNTER TELESCOPES IN INCLINED DIRECTIONS. D. A. Tidman and K. W. Ogilvie (Univ. of Sydney). Nuovo cimento (10) 6, 735-8(1957) Sept.

If the cross-sectional area of the telescope is not small compared with its length, a correction factor f, depending upon the geometry of the telescope, must be included in the calculations. Formulas are derived which allow the geometric correction to be evaluated rapidly to sufficient accuracy for most experimental purposes. (M.H.R.)

1531

MEASUREMENT OF IONIZATION ON DIPPING TRACKS IN NUCLEAR EMULSION. R. C. Kumar (Univ. Coll., London). Nuovo cimento (10) 6, 739-42(1957) Sept.

1532

THE DETERMINATION OF RADIOACTIVE DECAY CONSTANTS. F. Brown and G. R. Hall (Atomic Energy Research Establishment, Harwell). Nuovo cimento (10) 6, Suppl. No. 1, 283-93(1957).

The problem of accurate measurement of half lives is discussed, and the radioactive species are divided into three rather arbitrary groups: those which are so short lived that it is impossible to make a series of measurements of dN/dt as a function of time by conventional counting methods; those of moderate half life where the decay can be followed over several half lives, i.e., periods of a few seconds to a few months; and those of such long half life that no large change in dN/dt occurs in a reasonable time. The first group is not covered. Some difficulties and methods involved in the second group are discussed. The third group is discussed at length. Some instruments and methods covered are ionization chambers, electroscopes, mass spectrometry, accurate weighing, isotope dilution, calorimetric methods, and absolute α or β counting. (M.H.R.)

1533

THE EFFECTS OF DEGRADED RADIATION IN THYROID UPTAKE MEASUREMENTS. J. I. Trombka and Fearghus O'Foghludha (Oak Ridge Inst. of Nuclear Studies, Tenn.). Phys. in Med. and Biol. 1, No. 4, 340-51(1957) Apr.

The scintillation pulse-height spectra of patients who had been given I^{131} were examined with a gamma-ray spectrometer and compared with the spectra of dose standards. The spectra indicate how best to avoid errors in uptake measurements caused by degraded radiation; proper working conditions (distance, collimation) are assumed. It is concluded that the best solution of the uptake measurement problem is to exclude degraded radiation by differential counting. Errors in integral measurements may, however, be minimized by using a proper phantom and the design of such a phantom is discussed. (auth)

1534

A SINGLE CHANNEL SCINTILLATION SPECTROMETER. Kurt Franz and Santiago F. Pinasco. Publs. com. nac. energia atomica (Buenos Aires) Ser. fis. 1, No. 13, 225-42 (1957). (In Spanish)

A fast, compact one channel scintillation spectrometer has been developed, destined mainly for studies of isotopes with short or medium half lives. Performance data, circuits and methods for checking are presented in detail. (auth)

1535

CALORIMETRIC DETERMINATION OF THE RATIO OF ENERGY ADSORPTION TO IONIZATION FOR 22-Mev X-RAYS. L. D. Skarsgard and H. E. Johns (Univ. of Toronto); J. P. Bernier (Hôpital d l'Enfant-Jesus, Quebec); and D. V. Cormack (Univ. of Saskatchewan). Radiation Research 7, 217-28(1957) Sept.

1536

NEUTRON TIME-OF-FLIGHT SPECTROMETER FOR USE WITH THE HARWELL 110-INCH CYCLOTRON. J. P. Scanlon, G. H. Stafford, J. J. Thresher, and P. H. Bowen (Atomic Energy Research Establishment, Harwell, Berkshire, Eng.). Rev. Sci. Instr. 28, 749-57(1957) Oct.

A description is given of a neutron time-of-flight spectrometer used for energies up to 140 Mev. A 20-mμsec neutron pulse is obtained by electrostatic deflection of the internal proton beam of the cyclotron onto a thick aluminum target. By timing the neutrons over a 26-meter flight path an energy spread of 4.2% at 15 Mev is obtained rising to 14% at 140 Mev. The advantages of the technique and possible improvements are discussed. (auth)

1537

GAS SCINTILLATION COUNTER. A. Sayres and C. S. Wu (Columbia Univ., New York). Rev. Sci. Instr. 28, 758-64 (1957) Oct.

A systematic investigation of the optimum conditions for the design and operation of a gas scintillation counter has been made. The gases studied were Xe, Kr, Ar, He, and

various gas mixtures. Both a 6292 and a quartz window K1306 phototube were used with and without quaterphenyl as a wavelength shifter. Under optimum conditions an energy spread of less than 4% is obtainable for the Po^{210} α particles. The application of the gas scintillation counter as a fast slow neutron detector, using the reaction $B^{10}(n,\alpha)Li^{7}$, and its usefulness as a fast fission detector have been examined and discussed. (auth)

1538

RESPONSE OF AN ANTHRACENE SCINTILLATION COUNTER TO 10-120 kev ELECTRONS. L. W. Johnston, R. D. Birkhoff, J. S. Cheka, H. H. Hubbell, Jr., and B. G. Saunders (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 28, 765-7(1957) Oct.

Monoenergetic electrons from an electron accelerator were incident on a thin bare anthracene crystal centered on the photocathode of a RCA 6199 photomultiplier. A linear amplifier and single channel analyzer were used to obtain a pulse height distribution at each energy. The pulse height at the maximum of the distribution is a linear function of the incident electron energy with intercepts of 4.5 and 3.5 kev for 0.060- and 0.011-in. thick crystals, respectively. The pulse-height distribution could be fitted well with a Gaussian. The data indicate a linear relationship between the square of the full width of the pulse-height distribution at 1/e of the maximum and the electron energy. The average amount of electron energy absorbed in the crystal required to produce a photoelectron at the photocathode is 1.47 ± 0.09 kev/photoelectron for the 0.060-in. crystal and 1.32 ± 0.13 kev/photoelectron for the 0.011-in. crystal. (auth)

1539

USE OF A COMMERCIAL ELECTRON MULTIPLIER FOR POSITIVE ION COUNTING IN MASS SPECTROMETRY. Karl Koyama and R. E. Connally (General Electric Co., Richland, Wash.). Rev. Sci. Instr. 28, 833(1957) Oct.

Experiments with the electron multiplier from a type 6292 multiplier phototube, manufactured by Dumont Laboratories, have shown it to be satisfactory for positive ion counting. The study was made on a General Electric 6-in. radius, 60° sector-type analytical mass spectrometer which was modified to accomodate a surface-ionization ion source. (M.H.R.)

1540

ON AN ALUMINUM-WALLED DIFFUSION CLOUD CHAMBER. G. Caglioti and N. D'Angelo (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 28, 841-2 (1957) Oct.

A diffusion cloud chamber was built which had to be of a material with a relatively low macroscopic cross section for radiative capture of thermal neutrons. 61-S aluminum alloy was used. A polystyrene cylinder of a diameter a little smaller than that of the cylindrical body is used to insulate the sensitive region from the outside walls and to provide by means of a tape heater, the right temperature distribution along the boundaries of the sensitive region. (M.H.R.)

1541

WIDE-RANGE RADIATION DETECTOR. L. Cathey (E. I. du Pont de Nemours & Co., Inc., Aiken, S. C.). Rev. Sci. Instr. 28, 842-3(1957) Oct.

A simple form of the device in which the collector electrode of an ionization chamber is connected to the grid of an electrometer tube is diagramed. Its circuit is given. (M.H.R.)

1542

INVESTIGATION OF FUNCTIONING ELECTRONIC SPECTRA IN THE DOSIMETRY OF β AND γ RADIATIONS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/2. K. K. Aglintsev, V. P. Kasatkin, and V. V. Smirnov. London, Pergamon Press, Ltd., 1957. 11p.

1543

MEASUREMENT OF RADIOISOTOPES BY THE METHOD OF IONIZED AIRFLOW. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/5. F. Behounek. London, Pergamon Press, Ltd., 1957. 5p.

1544

VERY FINE-GRAINED EMULSIONS FOR NUCLEAR RESEARCH. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/7. N. A. Perfilov, N. R. Novikova, and E. I. Prokofyeva. London, Pergamon Press, Ltd., 1957. 14p.

A method for preparing extra fine grain photoemulsions with most probable microcrystal size of 0.04 to 0.08 μ and with great size uniformity is described. The emulsification process is controlled potentiometrically. (T.R.H.)

1545

UTILIZATION OF GLASSES AS INDUSTRIAL DOSIMETERS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/RIC/NS/192. F. Balestic, P. LeClerc, and M. Bonnaud. London, Pergamon Press, Ltd., 1957. 20p. (In French)

The effects of dose, ionization intensity, irradiation temperature, and wavelength on a cobalt glass were studied. Practical application in industrial dosimetry is discussed. (T.R.H.)

Mesons

1546 BNL-3405

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies. EIGHT LECTURES CONCERNING THE STRONG INTERACTIONS OF STRANGE PARTICLES, GIVEN AT BROOKHAVEN NATIONAL LABORATORY, JULY–AUGUST 1957. R. H. Dalitz. 72p. $12.30(ph OTS); $4.50(mf OTS).

Information on the established strongly-interacting particles, hyperons and K mesons, is reviewed. Discussions are included on the Gell-Mann–Nishijima classification scheme, charge independence in strange particle processes, the spins of K-particles and hyperons, the parity of strange particles, hypernuclear fragments, theoretical estimates of the hyperon-nucleon interaction, the possible existence of other particles, and symmetry properties proposed for strong interactions. (M.H.R.)

1547 AEC-tr-3024

ON THE PRODUCTION OF MESONS IN NUCLEON-NUCLEON COLLISIONS AND THE NUCLEON STRUCTURE. E. G. Bubelev. Translated from a publication of the Joint Inst. for Nuclear Research, U.S.S.R. 1956. 15p.

An effective cross section for the production of mesons and the relative losses of energy in inelastic peripheral collisions of nucleons with the energy T = 1 – 10 Bev are calculated on ground of the conception of the nucleon structure. It is essential that the presence of a core within a nucleon leads to two types of collisions with small and large energy losses. (auth)

1548 AEC-tr-3029

REMARKS ON THE ROLE OF STRANGENESS IN SLOW ELEMENTARY PARTICLE PROCESSES. L. Okun and B. Pontecorvo. Translated from Zhur. Eksptl'. i Teoret. Fiz. 32, 1587-8(1957). 5p.

It is suggested that an interaction mechanism common to all the slow processes of leptons and non-leptons exists. The close connection of the slow lepton and non-lepton processes on the one band and the failure of attempts to extend the notions of isotopic spin and strangeness on the other make it desirable to analyze the validity of these notions in slow non-lepton processes. The rule that the strangeness change $|\Delta S| = 1$ is investigated. Some consequences of the assumption that slow processes with $|\Delta S| = 1$ and $|\Delta S| \neq 1$ might be of comparable probabilities are considered in K-fragment and K meson processes. (M.H.R.)

1549 AEC-tr-3032

MESONIUM AND ANTIMESONIUM. B. Pontecorvo. Translated from a publication of the Joint Inst. for Nuclear Research, U.S.S.R. 1957. 7p.

Since Gell-Mann and Pais pointed out that K^0 and $\widetilde{K}^0$ particles are not identical, the possibility of $K^0 \rightarrow \widetilde{K}^0$ transitions induced by weak interactions makes it necessary to consider neutral K mesons as a mixture of particles of different parity. The question of the existence of other mixed neutral particles is discussed, (not necessarily elementary ones) which are not identical to the corresponding antiparticles, and for which particle-antiparticle transitions are not strictly forbidden. The number of possible systems are strongly limited by conservation laws for the number of barions and light fermions. Thus, apparently mesonium defined as the bound system (μ^+, e^-) is the only other mixed particle of interest existing among well known systems. These mesonium $\rightarrow$ antimesonium transitions are not forbidden and must take place due to known transitions. However, the mesonium–antimesonium transformation in the presence of matter is impossible. The probability (in vacuum) of emission of a fast positive or negative electron in the decay process, $[(\mu^+e^-) \rightarrow (\mu^-e^+) \rightarrow e^-$ fast $+ \nu + \widetilde{\nu} + e^+]$ is ~ 1 and $\sim \frac{1}{2}(\tau/\overline{\tau})^2$ respectively, when τ is the lifetime of a μ meson and $\overline{\tau}$ is the time characterizing this transformation. (M.H.R.)

1550

ON THE STATISTICS OF THE DETERMINATION OF THE MEAN LIFE OF μ-MESONS. L. Jánossy and D. Kiss (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 7, 107-10(1957).

Determination of the μ-meson decay constant by the maximum likelihood method was developed and applied to data available in the literature. (auth)

1551

RELATIVISTIC TWO-BODY PROBLEM IN THE CLASSICAL THEORY OF MESON FIELD. G. Marx (Roland Eötvös Univ., Budapest) and M. A. Ziegler (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 7, 125-33(1957).

The article deals with the motion of two particles of equal masses in a scalar meson field. The relativistic equation of motion, in which the retardation was also taken into account, was integrated numerically. At the point where the absolute value of the meson potential equals the value of the rest energy mc^2 of the particle the acceleration of the two particles attracting each other becomes zero and within this short distance changes its sign. (auth)

1552

OBSERVATION OF AN ASYMMETRY IN THE ANGULAR DISTRIBUTION OF THE $\pi \rightarrow \mu$ DISTRIBUTION. Horia Hulubei, Josef Ausländer, Elena Balea, Erwin Friedländer, Serban Titeica, and Tiberiu Visky. Compt. rend. 245, 1037-9(1957) Sept. 23. (In French)

1553

LONGITUDINAL POLARIZATION OF THE POSITRONS FROM THE DECAY OF UNPOLARIZED POSITIVE MUONS. G. Culligan, S. G. F. Frank, J. R. Holt, J. C. Kluyver, and T. Massam (Univ. of Liverpool). Nature 180, 751-2(1957) Oct. 12.

1554

A METHOD OF FIELD COUPLING. A. Houriet. Nuclear Phys. 4, 408-26(1957) Sept. (In French)

A new method of calculation of the nucleon-meson interaction is proposed. It is developed for the case of a pseudoscalar meson field coupled with nucleons by pseudoscalar coupling. The nucleon possesses isobars similar to those of the strong coupling theory, associated to a nuclear core. (auth)

1555

THE INTERACTIONS OF POSITIVE K-MESONS WITH NUCLEI IN PHOTOGRAPHIC EMULSION AT ENERGIES IN THE REGION 0 - 130 Mev. B. Bhowmik, D. Evans, S. Nilsson, and D. J. Prowse (H. H. Wills Physical Lab., Bristol) and F. Anderson, D. Keefe, A. Kernan, and J. Losty (Univ. Coll., Dublin). Nuovo cimento (10) 6, 440-77(1957) Sept.

Some 148 m of K^+ track have been followed in an unbiassed way and 109 inelastic interactions with emulsion nuclei found. In addition 3 K^+-proton scattering events have been found and numerous cases of elastic scattering from emulsion nuclei. The differential cross-section for the elastic scattering has been plotted for three energy intervals and the results compared with those predicted by the optical model for various nuclear well depths. The variation of cross-section with energy for the inelastic events is found to be consistent with isotropy if the Pauli Exclusion Principle is taken into account and the best fit for the experimental points is obtained for a repulsive potential well of 20 Mev. The inelastic events have been analyzed on the basis of the statistical model of the nucleus and an attempt has also been made to obtain from the experimental data the angular distribution in the C.M. system of the K-nucleon cross-section. On any reasonable assumption this appears to be peaked backwards. These data also demand a repulsive potential of ~ 20 Mev. The value of the average K-nucleon cross-section within nuclear matter for meson energies between 40 and 120 Mev is 4 mb/nucleon; allowing for the events forbidden by the exclusion principle this implies a cross-section of 6 mb on a free nucleon. Taking $\sigma_p = (14 \pm 3)$ mb, it follows that $\sigma_n = (2 \pm 2)$ mb. The ratio of charge exchange events to non-charge exchange events is $.20 \pm .07$—the value expected in the limit of a vanishingly small interaction in the $T = 0$ state. (auth)

1556

THE π-μ-e ASYMMETRY. D. H. Wilkinson (Cavendish Lab., Cambridge). Nuovo cimento (10) 6, 516-21(1957) Sept.

By comparing the apparent asymmetry of the μ-e decay observed for μ mesons stopping in Ilford G5 nuclear emulsion in cyclotron experiments with that for non-quenching substances such as graphite it is possible to measure γ_{G5}, the probability that the μ meson forgets its orientation on stopping in nuclear emulsion. This determination is independent of the degree of polarization of the μ-meson beam. This result may then be combined with the apparent asymmetry $1 + A \cos\theta$ directly observed for π-μ-e events in nuclear emulsion to find the true asymmetry $1 + \alpha \cos\theta$ for the fundamental π-μ-e process for all electrons observed without energy discrimination. A combination of results from the Columbia and Chicago cyclotron groups gives $\gamma_{G5} = 0.55 \pm 0.03$. A combination of results from eight groups of emulsion workers gives $A = -0.129 \pm 0.015$. These yield $\alpha = -0.287 \pm 0.039$ which corresponds to the value of the parameter of the two-component neutrino theory $\xi = 0.87 \pm 0.12$. (auth)

1557

ANGULAR DISTRIBUTION OF NEUTRONS FROM μ^- ABSORPTION IN NUCLEI. H. Überall (Univ. of Liverpool). Nuovo cimento (10) 6, 533-41(1957) Sept.

A general parity non-conserving absorption process of partly polarized μ^- mesons by protons in a nucleus is considered. The Fermi gas model is used to estimate the effect of the motion of the protons inside the nucleus on the anisotropy of the emitted neutrons. It is found that the anisotropy of the neutron distribution in the fundamental interaction is mostly preserved, especially towards the upper end of the neutron spectrum: thus an experiment to observe the neutron asymmetry seems feasible. (auth)

1558

NUCLEAR COLLISIONS OF NEGATIVE K-MESONS. W. Alles, N. N. Biswas, M. Ceccarelli, and J. Crussard (Max-Planck-Inst. für Physik, Göttingen). Nuovo cimento (10) 6, 571-84(1957) Sept.

An experiment was performed on the collisions of negative heavy mesons of energies ranging from ~5 to 90 Mev with nuclei of photoemulsion. The events were found by track scanning in a 15 cm × 17.5 cm × 9 cm stack which had been exposed to the enriched K^--beam of the Berkeley Bevatron. (auth)

1559

EXAMPLES OF K-MESON PRODUCTION IN 3 Gev π^--COLLISIONS. T. Bowen, D. M. Haskin, and M. Schein (Univ. of Chicago, Ill.). Nuovo cimento (10) 6, 592-600 (1957) Sept.

The production of K mesons by 3 Bev π^- mesons has been studied in an emulsion stack by area scanning for stopped K mesons and tracing to the originating interactions. Two examples of K-meson production are described which can be analyzed as due to pion-nucleon collisions. In one event a K^- meson is produced as the only charged particle. In the other event, a K^+ meson and a minimum ionization track are the only secondaries. This event can best be interpreted according to the scheme $\pi^- + P \rightarrow K^+ + \Sigma^0 + \pi^-$ assuming the collision to be with a free proton. Both of the events can be interpreted consistently with the Gell-Mann-Pais scheme. (auth)

1560

ISOTOPIC SPIN SELECTION RULES AND PARITY NON-CONSERVATION IN THE DECAY OF THE STRANGE PARTICLES. B. T. Feld (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (10) 6, 650-63(1957) Sept.

The experimental situation is reviewed on the decay ratios of the θ-meson and hyperons from the point of view of testing the validity of the suggested $\Delta T = \pm \frac{1}{2}$ selection rule. Assuming charge-independence, it is shown that the observed decay ratios of the Σ hyperons require a very large admixture of $\Delta T = \pm \frac{3}{2}$ decay, provided parity is conserved in the decay. However, if the requirement of parity conservation is discarded, the hyperon decay ratios can be accounted for, in a most natural fashion, while still preserving the $\Delta T = \pm \frac{1}{2}$ selection rule. This explanation leads to the prediction of large asymmetries in the angular distributions from the decay of polarized hyperons. Furthermore, these asymmetries are very sensitive to the degree of time-reversal invariance of the decay interaction. A table is given for the expected asymmetry parameters in parity non-conserving hyperon decays with and without time-reversal invariance. (auth)

1561

NON-ADIABATIC TREATMENT OF THE SCATTERING OF K^+-MESONS BY NUCLEONS. C. Ceolin and L. Tallone. Nuovo cimento (10) 6, 425-39(1957) Sept.

The problem of the K^+-nucleon scattering is treated with the method of Tamm-Dankoff in the two-meson approximation, both with scalar and pseudovector coupling. In both cases it turns out that the most important phase at low energy is T = 1, which corresponds to an attractive potential. In the scalar case this phase does not lead to a resonance; in the pseudoscalar case there is, however, a resonant state whose position, is strongly dependent on the momentum cut-off K. At the end of the work there is a brief discussion of the results obtained, in relation to the few experimental data so far available. (auth)

1562

THE RELATIVE FREQUENCIES OF THE DECAY MODES OF POSITIVE K-MESONS AND THE DECAY SPECTRA OF MODES $K_{\mu 3}$, τ' AND K_{β}. G. Alexander, R. H. W. Johnston, and C. O'Ceallaigh (Dublin Inst. for Advanced Studies, School of Cosmic Physics). Nuovo cimento (10) 6, 478-500 (1957) Sept.

Some 3,300 K-meson decay events have been studied in a large stack exposed to the positive K-beam at the Berkeley 6 Bev Bevatron. The events have been selected in an unbiassed way and have been used to yield preliminary information concerning the shape of the energy spectrum of the charged particle emitted in the rarer 3-body decay-modes τ', κ ($K_{\mu 3}$) and K_{β}. The relative abundance of the decay modes has been estimated, the results being summarized. The number of interactions observed over the first 4 cm from decay of the π mesons secondary to χ-decay yields the surprisingly short estimate of the interaction M.F.P. of (11.1 ± 2.4) cm. This appears to be in significant disagreement with that found for artificial π^+-mesons by other workers, namely 27 cm in the same energy region, (109 + 82) Mev. (auth)

1563

THE COUPLING CONSTANT OF THE MESON-NUCLEON INTERACTION. M. Cini and S. Fubini. Nuovo cimento (10) 6, Suppl. No. 1, 401-2(1957). (In Italian)

1564

DISPERSION RELATIONS FOR MESON-NUCLEON SCATTERING. Emil Kazes (Univ. of Chicago, Ill.). Phys. Rev. 108, 123-5(1957) Oct. 1.

Fourth-order meson-nucleon scattering amplitudes show that at least one subtraction is required for the no-spin-flip amplitudes and that subtraction is not needed for the spin-flip amplitudes used by Goldberger. (auth)

1565

HYPERONS AND K MESONS. PART I. GENERAL CHARACTERISTICS OF HYPERONS AND K MESONS. M. A. Markov. Joint Institute of Nuclear Research. 126p. and illustrations. Mar. 1957. (In Russian)

A rough draft is given of the book of lectures presented by the author at the Moscow State Univ. in 1957 and of reports given at various times at the Joint Inst. of Nuclear Research. The first part of the book deals with the properties of hyperons and mesons and their production; the θ^0 and $\tilde{\theta}^0$ particles; the invariance of charge conjugation; the life times of θ and $K^{\pm}$ mesons; decay reactions $\theta^0 \rightarrow \pi^0 + \pi^0$, $K^0_{\mu 3} \rightarrow \mu^+ + \nu + \pi^0$, and $K_{\beta 3}$; the τ meson and the doublets in parity; conservation of parity; and anomalous decay of K mesons. (R.V.J.)

1566

HYPERONS AND K MESONS. PART II. ISOTOPIC SPIN AND SYSTEMATICS OF FUNDAMENTAL PARTICLES. M. A. Markov. Joint Institute of Nuclear Research. 216p. and illustrations. Mar. 1957. (In Russian)

The isotopic invariance in various types of interactions, the development of isotopic formalism and formal scheme for classical particle classification, four dimensional variance of the isotopic spin, and further development of tridimensional variance are discussed, as well as structural

concepts in the theory of fundamental particles and M. Goldhaber's scheme (Phys. Rev. 101, 433(1956)). (R.V.J.)

1567

CAPTURE OF K MESONS WITH EMISSION OF He^5. B. Bannik, D. Kopylova, and A. Nomofilov. Joint Institute of Nuclear Research. Laboratory of High Energies. May 1957. 7p. (In Russian)

1568

FORMATION OF NEUTRAL π MESONS BY NEUTRONS IN DEUTERIUM AND COMPLEX NUCLEI. V. P. Dzhelepov, K. O. Oganesyan, and V. B. Flyagin. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. 1957. (In Russian)

Results are given of measurements, at 90° angle, of γ-quanta yield from π° meson fission induced by ~590 Mev neutrons in deuterium. The full cross sections of π°-meson formation in (n-d) and (n-n) collisions were found to be $\sigma_{nd}^{\pi^\circ} = (7.4 + 2.0) \times 10^{-27}$ cm^2 and $\sigma_{nn}^{\pi^\circ} = (1.7 \pm 0.5) \times 10^{-27}$ cm^2. Data are also given on the relative γ yield from π° mesons formed on various elements. The relation of γ yield is close to the function $A^{\frac{1}{3}}$. (To be translated. The translation will be announced in NSA, when available.) (tr-auth)

1569

ELASTIC SCATTERING OF π^+ AND π^- MESONS ON He NUCLEI AT 300 MEV. M. S. Kozodaev, R. M. Sulyaev, A. I. Filippov, and Yu. A. Shcherbakov. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. 1957. 7p. (In Russian)

Investigations were made of the elastic scattering of π^+ and π^- mesons in the He nuclei at 300 Mev to determine the angular distribution and to check the previous conclusions about the effects of Coulomb interference. (R.V.J.)

1570

A POSSIBLE CASE OF τ-MESON DECAY WITH EMISSION OF AN ELECTRON-POSITRON PAIR. A. Nomofilov. Joint Institute of Nuclear Research. Laboratory of High Energies. 4p. May 1957. (In Russian)

A heavy meson decay with τ^+ meson and electron-positron pair production was observed in a layer of emulsion irradiated in the stratosphere. Measurements of various tracks and the geometry of the case were studied to confirm the possibility of decay with electron-positron pair emission. (To be translated. The translation will be announced in NSA, when available.) (R.V.J.)

1571

FORMATION OF π^+ MESONS IN p–p COLLISIONS IN 480 TO 660 MEV REGION. B. S. Neganov and O. V. Savchenko. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. May 1956. (In Russian)

Energy spectra of π-meson reactions $p + p \rightarrow \pi^+ + n + p$ and $p + p \rightarrow \pi^+ + d$ were measured in an isolated proton beam of energy 660 Mev. The total cross section for the reaction $p + p \rightarrow \pi^+ + n + p$ equals (1.9 ± 1.1) mb with the angular distribution proportional to $(0.66 \pm 0.14) + \cos^2\theta$. The function of the excitation reaction $p + p \rightarrow \pi^+ + n + p$, measured in the energy range 480 to 660 Mev, was developed using the approximation of power dependence 0.67 P_{max} mb, where P_{max} is the maximum meson pulse expressed in units $m_\pi + c$. (tr-auth)

Molecular Properties

1572

ELECTRON DIFFRACTION ANALYSIS IN THE U.S.S.R. S. A. Semiletov. J. Sci. Ind. Research (India) 16A, 377-93 (1957) Sept.

Neutrons

1573 ASAE-11

American Radiator and Standard Sanitary Corp. Atomic Energy Div., Redwood City, Calif.

TRANSMISSION OF NEUTRON FLUX THROUGH GRAPHITE DUCTS. M. J. Novak. Apr. 1, 1957. 12p.

An analysis was made of neutron transmission, based on two-group theory, through graphite ducts. The results are applicable to both circular and rectangular ducts in a wide range of sizes. Graphs were prepared which show the axial fast and slow flux distributions from unit neutron sources. (D.E.B.)

1574 NAA-SR-1940

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE NEUTRON VELOCITY SPECTRUM IN A HEAVY MODERATOR. E. Richard Cohen. Oct. 15, 1957. 39p. Contract AT-11-1-GEN-8. $1.25(OTS).

The differential equation developed by Wilkins to represent the velocity spectrum of neutrons in a heavy moderator is investigated for the case of 1/v absorption. An exact solution to terms of second order in the absorption parameter allows an accurate determination of the asymptotic neutron density. For large absorption parameters a numerical integration can yield higher accuracy. The analytic solution is applied to the calculation of the total migration area of neutrons from a monoenergetic source. (auth)

1575

NOMOGRAPHS FOR FAST NEUTRON SPECTROSCOPY. E. Bujdosó and L. Medveczky (Hungarian Academy of Sciences, Debrecen) and S. Török (Secondary Tech. School of the Eng. Industry, Debrecen). Acta Phys. Acad. Sci. Hung. 7, 373-7(1957).

1576

MEASUREMENT OF NEUTRON SPECTRA IN MODERATORS AND REACTOR LATTICES AQUEOUS MODERATORS. I. M. J. Poole (Atomic Energy Research Establishment, Harwell, Berks). J. Nuclear Energy 5, 325-41 (1957).

The application of pulsed source time-of-flight techniques to the measurement of reactor lattice and moderator spectra is described. Results are given for a series of measurements on the spectrum in water loaded with boric acid, and compared with the predictions of theory. (auth)

1577

SLOWING DOWN OF NEUTRONS IN BERYLLIUM FROM 1.44 ev TO THERMAL ENERGY. L. S. Kothari and K. S. Singwi (Atomic Energy Establishment, Bombay, India). J. Nuclear Energy 5, 342-56(1957).

The slowing down of neutrons in beryllium in the energy range 1.44 ev to thermal was studied. Taking beryllium temperature to be 300°K, the elastic scattering cross-section as a function of neutron energy and the cross-section for a neutron going, in a single collision, from any given initial energy to any other final energy, are calculated. The time variation of the temperature of the neutron distribution has also been calculated. One finds that it exponentially approaches equilibrium at 296°K, with a relaxation time of 19 μsec. Assuming the distribution to be in equilibrium with the moderator when its temperature is 300°K, we find that the age from 1.44 ev to thermal is 20 cm^2, and that the time taken by neutrons to slow down in this energy interval is 100 μsec. The total calculated age from fission energy to thermal is 101 cm^2, and the total slowing-down time is 113 μsec. (auth)

1578

A HIGH OUTPUT D-D NEUTRON GENERATOR FOR

BIOLOGICAL RESEARCH. A. C. van Dorsten and J. H. Spaa (Phillips Research Labs., Eindhoven-Netherlands). Nuclear Instr. 1, 259-67(1957) Sept.

A description is given of an apparatus capable of producing a fast neutron flux exceeding 10^{10} neutrons per second from a D–D reaction. The set consists of a pressurized cascade generator and an accelerator tube with a rotary heavy ice target. The rectifiers used are of the Se type. (auth)

1579

EXPERIMENTAL LIMIT TO THE ELECTRIC DIPOLE MOMENT OF THE NEUTRON. J. H. Smith, E. M. Purcell, and N. F. Ramsey (Oak Ridge National Lab., Tenn. and Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 120-2(1957) Oct. 1.

An experimental measurement of the electric dipole moment of the neutron by a neutron-beam magnetic resonance method is described. The result of the experiment is that the electric dipole moment of the neutron equals the charge of the electron multiplied by a distance $D = (-0.1 \pm 2.4) \times 10^{-20}$ cm. Consequently, if an electric dipole moment of the neutron exists and is associated with the spin angular momentum, its magnitude almost certainly corresponds to a value of D less than 5×10^{-20} cm. (auth)

Nuclear Physics

1580 ANL-5754

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] APRIL THROUGH JUNE 1957. Aug. 1957. 100p. Contract W-31-109-eng-38. $2.75(OTS).

A laminated scintillator was constructed of Ag activated ZnS in fused B_2O_3. The efficiency of this scintillator was determined and compared with other scintillators. J-values of 0 for the 41.5 and 44.5 ev and 1 for the 52.6 ev resonances in Pu^{239} were determined. New cross section values are reported for U^{235}. Additional attempts to establish fission product mass distribution as a function of neutron energy are reported. A method of analyzing neutron resonances by using partial areas rather than the total area is described. Experiments were conducted to study the fission yield from U^{235} using resonance neutrons in the range 1 to 10 ev. Fission product analyses were compared with an analysis of pile irradiated U^{235}. No differences in fission yields were detected in the range studied. Modifications in the Van de Graaff charging system were made in an attempt to improve charging efficiency and belt life. Angular distributions of neutrons from the reactions $Mn^{55}(p,n)Fe^{55}$ were plotted for the ground, 420, 930, and 1310 kev states. Measured angular distributions from the reaction $Li^6(\alpha,\gamma)B^{10}$ were compared with theoretical distributions. The observed resonances, gamma rays, and angular-distribution coefficients are reported. Additional data are reported on the decay schemes of Sn^{123}, Fe^{52}, and Eu^{152}. Proton strength function measurements indicate a maximum at $A \approx 75$. A complete list of the resonance energies of Al^{27} and corresponding energy levels in Al^{28} was prepared. A polarized neutron beam from the Argonne Research Reactor was used to observe the beta decay of neutrons parallel and antiparallel to their spins. The ratio 0.62 ± 0.10 was determined. Positron polarization and annihilation was investigated in Co, Fe, Ni, Cu, and Gd. The relative light outputs of liquid scintillators using toluene and isopropylbiphenyl solvents and p-terphenyl, diphenyloxazole, and phenylbiphenylyl-oxadiazole were determined. Higher efficiencies were obtained with the isopropylbiphenyl scintillators. Mass spectrometer techniques were used to study the vaporization of BeO, UO_2, and Al_2C_2. Vapor pressures and heats of vaporization are given. Mass spectrometric analyses were made of the fragments from nuclear transformations of $Br^{80(m)}$ in dibromoethane and T in ethane. Studies of the break-up of CH_4 under electron impact support a value of ≈ 170 kcal/mol for the heat of vaporization of C. Methods for the analysis of angular distribution are discussed. (For preceding period see ANL-5698.) (D.E.B.)

1581 HW-50598

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1957. May 31, 1957. 38p. Contract W-31-109-Eng-52. $1.25(OTS).

The circuitry of a vernier chronotron for measuring times in the mμsec region is presented. A series of buckling measurements were completed on a 4 by 4 by 6 ft graphite-1.44% U^{235} lattice. The U was in the form of hollow slugs, cooled internally and externally by H_2O. Buckling values are given for both wet and dry conditions for several lattice spacings and Al/U and C/U ratios. Neutron diffusion lengths in graphite were measured as a function of temperature in the range 20 to 600°C. Thermal flux calculations were made for a 19-rod cluster of 0.5 in. Al-clad UO_2 rods in a 7-in. D_2O lattice. A method is presented for evaluating the effect of neutron moderation in U on resonance capture. The method is applied to a lattice of cylindrical U rods. Thermal utilization calculations were made for square, rhombic, and cylindrical lattices. Two criteria are given for determining the correct value of the thermal multiplication factor of a lattice in the Physical Constants Testing Reactor. A detailed discussion of the application of small source theory to heterogeneous reactor critical conditions is given. (For preceding period see HW-42182.) (D.E.B.)

1582 PR-P-34

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] APRIL 1, 1957 TO JUNE 30, 1957. 97p. (AECL-485).

Experimental studies of cosmic-ray neutron production in lead indicate a mean production rate of 6.5 ± 0.4 n $kg^{-1}m^{-1}$. Newton's level density theory was applied in fission mode studies. This procedure gave the mass yield curve correct to the general order of magnitude; greater accuracy depending on further theoretical refinement. The results of studies of Eu^{150} and Pr^{144} disintegration are reported. In studies of weak resonances in the reaction $Mg^{24}(p,\gamma)Al^{25}$, an unreported state in Al^{25} was found at 4.03 Mev from a proton energy of 1.83 Mev. Other reactions investigated were $Mg^{25}(\alpha,n\gamma)Si^{28}$ and $Mg^{24}(d,p)Mg^{25}$. A phase shift analysis of the elastic scattering angular distribution of protons by N was completed. Values of the energies and gamma-ray branching ratios of excited states observed in the reactions $O^{16}(He^3,p)F^{18}$ and $N^{14}(\alpha,\gamma)F^{18}$ are reported. The Ti^{49} spectrum was investigated in the range 0.34 to 11.0 Mev. The radiations observed are tabulated. A value of 0.08 ± 0.02 b is reported for the radiative capture cross section of N^{14}. Developments in radiation detection instruments, counting techniques, and associated electronic equipment are reviewed and discussed. The neutron spectrum was calculated for a fresh NRX rod. Oscillations in the intermolecular potential function of liquid Ar which appear in neutron diffraction measurements are discussed. A complete mathematical description of the neutron spectrum in the vicinity of an absorbing slab was prepared. The effective thermal diffusion length of a heterogeneous reactor was defined by equating the expressions for the thermal non-leakage

probability of the heterogeneous reactor to those of a homogeneous reactor of the same dimensions. (For preceding period see PR-P-33.) (D.E.B.)

1583 AEC-tr-3025

WHEN DOES WEAK INTERACTION BECOME STRONG? D. Blokhintsev. Translated from Uspekhi Fiz. Nauk 62, 381-3(1957). 6p.

In previous work, a strong interaction was considered as such when during the collisions of the particles their energy is concentrated mainly in the interaction energy but not in their proper kinetic one. It appears that the weak interaction of electrons with the participation of μ mesons and neutrinos may become strong in the sense defined above. The proof of this assertion is given. (M.H.R.)

1584

CONTRIBUTION TO THE STUDY OF THE EFFECTS OF CHARGE EXCHANGE IN PHOTODISINTEGRATION OF THE DEUTERON. P. Meyer. Ann. phys. 2, 498-550(1957) July-Aug. (In French)

Charge exchange plays an important role in deuteron photodisintegration at intermediate energies. Using a covariant formalism, a relativistic expression was obtained for the probability of transition beginning with a bound state. Separating these expressions, the effect of mesic charge exchange in photodisintegration has been calculated at the 2^e and at the 4^e order of g. The results permit the explanation of the increase in the effective isotropic cross section for photodisintegration observed experimentally. (tr-auth)

1585

DISPERSION RELATIONSHIPS IN CASES OF WEAK INTERACTIONS. N. N. Bogolyubov, S. M. Bilen'kiĭ, and A. A. Logunov (Joint Inst. of Nuclear Research). Doklady Akad. Nauk S.S.S.R. 115, 891-3(1957) Aug. 11. (In Russian)

Analysis was made of the reaction $\mu + p \rightarrow n + \nu$ where simultaneously with the weak interaction takes place a strong interaction of nucleon and meson fields. (R.V.J.)

1586

MATRIX ALGEBRA IN THE THEORY OF PARTICLES WITH $^3/_2$ SPIN. E. E. Fradkin (Gertsen Leningrad State Pedagogical Inst.). Doklady Akad. Nauk S.S.S.R. 115, 907-10(1957) Aug. 11. (In Russian)

The basic ratios were developed for matrix algebra with a unit system where Planck's constant and the velocity of light are equal to unity participating in the wave equation of the particle with unique $^3/_2$ spin and a positively determined complete charge. (R.V.J.)

1587

INVESTIGATIONS OF RaC(Bi^{214}) γ-RAY SPECTRA. B. S. Dzhelepov and S. A. Shestopalova (Mendeleev All-Union Research Inst. of Metrology). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 990-1001(1957) July. (In Russian)

The total γ-ray energy per one RaC(Bi^{214}) decay was found to equal 1.61 Mev. Tables of quantum number of decay for RaC, calculated on the basis of the relative intensities and the above energy, are presented. (R.V.J.)

1588

ON THE RADIUS OF THE ALPHA-PARTICLE. I. I. Levintov (USSR Academy of Sciences, Moscow). Nuclear Phys. 4, 330-6(1957) Sept.

The parameters of the alpha particle potential are estimated from data relating to the polarization and cross section for scattering of 315 Mev protons on He^4. Comparison with low energy data indicates that the p–He^4 interaction range decreases by 30% when E_p increases from ≈10 Mev to ≈300 Mev. (auth)

1589

β-γ-CORRELATION FOR ALLOWED TRANSITIONS INVOLVING NON-CONSERVATION OF PARITY. Yu. V. Gaponov and V. S. Popov (Moscow State Univ., U.S.S.R.). Nuclear Phys. 4, 453-6(1957) Sept.

The angular correlation between the directions of emission of electron and circularly-polarized γ quantum in cascade β-γ transitions is considered for allowed β transitions, taking account of parity non-conservation. The effect of the nuclear Coulomb field is neglected. (auth)

1590

COMPOUND NUCLEUS FORMATION AS AN IRREVERSIBLE THERMODYNAMICAL PROCESS. C. E. Porter (Åbo Akademi and Univ. of Turku, Finland). Nuclear Phys. 4, 472-6(1957) Sept.

It is emphasized that in the energy region where the level widths are much smaller than the spacings between levels compound nucleus formation is appropriately characterized as an irreversible thermodynamical process and that therefore there is an analog of the Nyquist formula in which the strength function plays the role of the customary admittance factor. (auth)

1591

CHARGE CONJUGATION AND ANGULAR MOMENTUM. C. B. van Wyk (Univ. of Orange Free State, Bloemfontein, South Africa). Nuovo cimento (10) 6, 522-32(1957) Sept.

The formal correspondence between spin and charge as implied by the idea of isobaric spin, is explained by showing that rotations in three- and four-dimensional spaces can be expressed as generalized phase transformations. Reflections in three dimensions are also expressed as phase transformations, the eigenfunctions of which are linearly related to those of suitable rotations. It is shown that the Kramers-Pauli charge conjugation is the charge analogue of spin in four dimensions. Hence the charge conjugation formalism presents a spin angular momentum framework which is applicable to particles with two types of spin. The four-dimensional orbital angular momentum eigenfunctions are given as a generalization of spherical harmonics. (auth)

1592

THE PARITY OF ELEMENTARY PARTICLES. P. T. Matthews (Univ. of Rochester). Nuovo cimento (10) 6, 642-9(1957) Sept.

In determining the intrinsic parities of elementary particles, the invariance of the interactions under gauge transformations makes the relative parity of certain groups of particles a matter of convention. On the other hand, charge independence puts definite restrictions on the relative parities of the members of isotopic multiplets. The interplay of these conventions and restrictions is analyzed and the general considerations applied to the known particles. (auth)

1593

NON-STATIC EFFECTS ON INDIVIDUAL NUCLEONS IN A SPHEROIDAL POTENTIAL. W. E. Frahn and R. H. Lemmer (National Physical Research Lab., C.S.I.R., Pretoria, South Africa). Nuovo cimento (10) 6, 664-73(1957) Sept.

A generalized single-particle wave equation is derived in the effective mass approximation, starting from a non-local potential matrix for the nucleon-nucleus interaction as required by recent work on the nuclear many-body problem. The effective nucleon mass appearing in the kinetic energy operator of this equation depends on the shape of the local potential which is assumed as the static limit of the non-local interaction. The non-static effects on the motion of individual nucleons in non-spherical nuclei are illustrated using a spheroidal oscillator potential. By a perturbation treatment of the energy eigenvalue problem, it is shown that the non-static problem is approximately equivalent to a static one with a modified deformation parameter. (auth)

1594
CORRELATION BETWEEN CIRCULARLY POLARIZED γ-RAYS AND β-PARTICLES. A. Lundby, A. P. Patro, and J. P. Stroot (CERN, Geneva). Nuovo cimento (10) 6, 745-7(1957) Sept.

The nonconservation of parity in β decay was demonstrated by measuring the circular polarization of γ rays following β transitions as a function of the angle between the momenta of β and γ. The measurement of the transmission rather than the differential scattering of γ rays was preferred due to the ease with which energy discrimination can be achieved in the former case. (M.H.R.)

1595
THE THEORETICAL ASPECTS OF THE PHYSICS OF NEW PARTICLES. G. Morpurgo. Nuovo cimento (10) 5, Suppl. No. 3, 417-28(1957). (In Italian)

1596
ON THE MEASUREMENT OF VELOCITY OF RELATIVISTIC PARTICLES. Y. Aharonov and D. Bohm. Nuovo cimento (10) 5, Suppl. No. 3, 429-39(1957).

Discussions are included on measurements of velocity for relativistic particles not satisfying Dirac's equation and also those satisfying this equation. Material on the motion of particles satisfying Dirac's equation is presented. It is concluded that the measurement proposed by Dirac does not permit a clear manifestation of the new features of the velocity implied by the Dirac equation. (M.H.R.)

1597
SPIN AND PARITY OF THE NEUTRAL PION. Toichiro Kinoshita and Ronald F. Peierls (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 161-3(1957) Oct. 1.

Recent observations of anisotropy in the angular distribution of π-μ decay has raised some doubt as to the spin of the pion, which is generally believed to be zero. The vanishing point of the pion spin is deduced from a detailed balance study of the processes $\pi^+ + d \rightleftarrows p + p$; however, this agreement must be modified if the pions are polarized. Alternate methods of pion spin determination are discussed. (A.C.)

1598
ANGULAR CORRELATION MEASUREMENTS. STUDIES OF RELATIVE TRANSITION PROBABILITIES OF GAMMA RADIATION AND OF INTERNAL COMPTON EFFECT. EXPERIMENTS OF NUCLEAR g- FACTORS. Torsten Lindqvist. Uppsala, Almqvist & Wiksells Boktryckeri AB, 1957. 6p.

Some general remarks on angular correlation measurements are given. Experiments reported in seven previously published articles are briefly described. (M.H.R.)

1599
ON NUCLEAR MATTER FLUCTUATION. D. Blokhintsev. Joint Institute of Nuclear Research, 1957. 14p.

It is shown that the appearance of energetic fragments from the collision of fast nucleons with nuclei may be considered as the product of the nucleon collision with the nuclear matter in a state of fluctuation. (auth)

Nuclear Properties

1600
FIRST EXCITED STATE IN AXIALLY SYMMETRIC EVEN-EVEN NUCLEI. G. F. Filippov. Doklady Akad. Nauk S.S.S.R. 115, 696-8(1957) Aug. 1. (In Russian)

Attempts were made to evaluate the rotation-oscillation spectra for axially symmetric nuclei. The assumption of conservation of axial symmetry holds for the first excited states. Estimations were made for all heavy and semi-heavy nuclei (A > 70) with known spectra for first excited states. For a large group of nuclei the first excited states are approximately equidistant, and in case of positive parity have a spin of 2. The theoretical 0^+ level, which should be found alongside the lower level 2^+, has not been observed, possibly due to some degree of inaccuracy in the experiment. Nuclei with small deformation power (Pb^{208}, Sr^{88}, Ge^{146}, and Po^{210}) do not fit into the scheme. (R.V.J.)

1601
IDENTITY OF SPIN TEMPERATURE AND THERMODYNAMIC TEMPERATURE. Anatole Abragam and Warren Proctor. Compt. rend. 245, 1048-50(1957) Sept. 23. (In French)

An experiment designed to prove the identity of thermodynamic temperature and spin temperature, as it is defined in magnetic resonance studies, is described. (tr-auth)

1602
Pu^{238} α DECAY. L. N. Kondrat'ev, G. I. Novikova, et al. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 907-8(1957) July. (In Russian)

The high excitation rotational states of U^{234}, recorded during Pu^{238} α decay, were measured with a magnetic α spectrometer. The Pu^{238} was obtained as the product of Cm^{242} α decay formed during Am^{241} bombardment in a flux of slow neutrons. A chromatographic method was used to achieve a complete separation of Pu and Am; thus Am^{241} α lines were not observed in the obtained α spectra. Measurements at 40 and 110 hr were taken, and the decay scheme of Pu^{238} and energy levels of U^{234} are shown. Measurements revealed α lines with energies of 5.352 and 5.208 Mev. Intensities of corresponding transitions were $0.13 \pm 0.01\%$ and $(5 \pm 1) \times 10^{-3}\%$. In the energy level from 5.210 to 5.350 Mev the intensity lines do not exceed $2 \times 10^{-3}\%$. The weak α line obviously belongs to Pu^{238}. Results of all measurements are presented in tabular form. The levels fit well into the rotational scheme for even-even parity nuclei. (R.V.J.)

1603
ENERGY OF Po^{210} α PARTICLES. I. I. Agapkin and L. L. Gol'din. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 909-12 (1957) July. (In Russian)

The energy of Am^{241} α particles, with previously assigned values of 5476.6 ± 2 kev (with Rn^{222} source holder) and 5482.0 ± 0.6 kev (with Po^{210}), is compared with the energy of Po^{210} α particles measured with Ra^{224}(ThX) as source holder. Results of measurements suggested for the energy of Po^{210} α particles the value 5297.8 ± 1.5 kev. (R.V.J.)

1604
Mg^{24} ROTATION LEVELS. L. K. Peker, L. V. Gustova, and O. V. Chubinskiĭ. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1013-16(1957) July. (In Russian)

The excitation levels of Mg^{24} (E > 4.12 Mev) have been investigated. Data on the nuclear state of Mg^{24} at energies up to 9 Mev and the β decay of two isobar nuclei, Na^{24} (β^-) and Ar^{24} (β^+), are presented in graphic form. (R.V.J.)

1605
SPINS AND PARITIES OF DEFORMED ODD-ODD NUCLEI. L. K. Peker (Gor'kiĭ Library of Acad. of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1029-33(1957) July. (In Russian)

1606
THE TOTAL EFFECTIVE CROSS-SECTIONS OF U^{233}, U^{235}, Pu^{239} AND THE FISSION CROSS-SECTION OF U^{235} IN THE RESONANCE REGION. V. V. Sokolovsky, V. V. Vladimirsky, I. A. Radkevich, and A. A. Panov. J. Nuclear Energy 5, 389-401(1957).

1607
NUCLEAR MAGNETIC MOMENTS AND THE MANY BODY PROBLEM. J. S. Bell (Atomic Energy Research Estab-

lishment, Harwell, Berks). Nuclear Phys. 4, 295-312(1957) Sept.

The Brueckner theory predicts corrections to the shell model moments of even such simple nuclei as N^{15}, O^{17}, and K^{39}. Calculation is difficult because of the many states excited by the model operator. To obtain some notion of orders of magnitude a simple model is examined in which the core is represented by a uniform Fermi gas; the summations then become integrals in momentum space. It is assumed, as is usual in shell model work, that the effective two-body potential can be crudely represented by a static central potential with exchange. The second order corrections are found to be of the same order of magnitude as, but somewhat smaller than, the effect in first order of the usual space-exchange current. (auth)

1608

LOW LYING LEVELS IN Th^{228}. S. Bjørnholm, O. Nathan, O. B. Nielsen, and R. K. Sheline (Univ. of Copenhagen). Nuclear Phys. 4, 313-24(1957) Sept.

The decay scheme $Ac^{228} \rightarrow Th^{228}$ has been reinvestigated. The observation of new conversion lines and coincidence relations establish a revised decay scheme. An analysis of the level scheme in the light of the unified model classifies the levels as members of two rotational bands above the ground state band. Two states of energies 328 and 396 kev with K = 0 and $I = 1^-$ and 3^- are interpreted as an octupole vibrational band, and states at 966 and 1018 kev with K = 2 and $I = 2^+$ and 3^+ as a γ-vibrational band. The presence of a second octupole vibrational band with K = 2 and $I = 2^-$, 3^-, ... is suggested. The close similarity with the level schemes of other strongly deformed nuclei in the actinide as well as in the lanthanide regions is emphasized. (auth)

1609

THE DECAY OF ^{109}Cd, $^{109}Ag^*$ AND ^{109}Pd. A. E. Wapstra and W. Van Der Eijk. Nuclear Phys. 4, 325-9(1957) Sept.

The K conversion coefficient of the 88 kev E3 gamma ray in Ag^{109*} is found to be 10.3 ± 0.5. The theoretical value is 11.6. The electron capture decay energy of Cd^{109} to this level of 75^{+15}_{-10} kev is obtained from the ratio of K and L capture. Gamma rays of 305 and 410 kev which could originate from known levels at these energies in Ag^{109} occur for 0.07% and <0.03% per decay of Pd^{109}. (auth)

1610

ROTATIONAL SPECTRA OF NUCLEI FOLLOWING O^{16}. G. Rakavy (Univ. of Copenhagen and CERN Theoretical Study Division, Copenhagen). Nuclear Phys. 4, 375-94 (1957) Sept.

The possibility of the application of the strong coupling collective model (rotational model) to nuclei in the region following O^{16} (s–d shells) is discussed. A calculation shows that nuclei with big deformation may be expected in the considered region. In the light of this result the experimental data on nuclei up to A = 25 are reviewed, and it is shown that they are consistent with the general implications of the model. (auth)

1611

A FURTHER STUDY OF THE DECAY OF Ir^{192}. J. Mráz (Central Research Inst. for Physics, Budapest). Nuclear Phys. 4, 457-62(1957) Sept.

The angular correlations of 308–316, 308–296 and 296–316 kev gamma cascades in the radiations of Pt^{192} were measured to remove the ambiguities in the spin assigned to the fourth excited level of Pt^{192}. In the discussion an interpretation of the excited levels of Pt^{192} is given. (M.H.R.)

1612

THE 3^- LEVEL IN A^{40}. R. Thieberger (Weizmann Inst. of Science, Rehovoth and Israel Atomic Energy Commission, Tel-Aviv) and A. De-Shalit (Weizmann Inst. of Science, Rehovoth). Nuclear Phys. 4, 469-71(1957) Sept.

The calculation of the 3^- level in Ar^{40} is attempted. The calculation is based on comparing energy levels in neighboring nuclei. The result obtained is 2.51 Mev. (auth)

1613

ANGULAR CORRELATIONS OF GAMMA RAY CASCADES FOLLOWING THE DECAY OF Eu^{152}. S. Ofer (Hebrew Univ., Jerusalem). Nuclear Phys. 4, 477-87(1957) Sept.

The angular correlations of five γ-ray cascades following the decay of Eu^{152} to Sm^{152} and to Gd^{152} were measured. From these measurements, assignments for the spins of excited levels and multipolarities of the γ radiations are made. The results strongly support the suggestion that the 1082 and 1226 kev levels of Sm^{152} should be interpreted as collective vibrational levels. (auth)

1614

ANOMALOUS MAGNETIC MOMENT OF THE NUCLEON. S. Okubo (Univ. of Rochester). Nuovo cimento (10) 6, 542-58(1957) Sept.

Miyazawa's method of calculation of the anomalous magnetic moment of the nucleon is given a covariant extension by using covariant dispersion relations. In this connection, some attention is paid to the difference between covariant and non-covariant definitions of magnetic moment from meson current contribution. (auth)

1615

A SHORT LIVED ISOMERIC STATE OF ^{208}Bi. S. De Benedetti, U. Farinelli, F. Ferrero, R. Malvano, G. Pelli, and C. Tribuno. Nuovo cimento (10) 6, 682-5(1957) Sept.

A previously known isomeric activity of 2.5 ms from irradiation of Bi has been assigned to Bi^{208}. The method used was the observation of the excitation curve from betatron radiation on stable Bi: the shape of the curve and its threshold are characteristic of (γ, n) reactions. The problem of the ground state of Bi^{208} is discussed. (auth)

1616

BACKSCATTERING OF POSITRONS FROM Na^{22}. A. Cambieri and R. Pappalardo. Nuovo cimento (10) 6, 743-4 (1957) Sept. (In Italian)

1617

A NEW DETERMINATION OF THE GYROMAGNETIC RATIO OF PROTONS. F. Kirchner and W. Wilhelmy. Nuovo cimento (10) 6, Suppl. No. 1, 246-53(1957). (In German)

1618

THE MASSES OF THE LIGHT NUCLIDES. J. Mattauch. Nuovo cimento (10) 6, Suppl. No. 1, 254-73(1957). (In German)

1619

ABSOLUTE PRECISION MEASUREMENTS OF NUCLEAR ENERGY LEVELS AND THEIR BREADTHS IN TERMS OF FUNDAMENTAL ATOMIC CONSTANTS. H. H. Staub (Univ. of Zürich). Nuovo cimento (10) 6, Suppl. No. 1, 306-14(1957).

In order to describe nuclear energy levels it is important to know the energy and breadth of the level. In this measurement the energy of the incident protons is determined by deflection in a homogeneous magnetic field, whose value and configuration can be measured with a very high degree of accuracy with nuclear magnetic resonance. The apparatus is diagramed and results are given for Li and Al resonances and two in F. (M.H.R.)

1620

PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE OF Ce^{141} AND Nd^{147}. R. W. Kedzie, M. Abraham, and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 108, 54-7(1957) Oct. 1.

The microwave paramagnetic resonance hyperfine structures of 33-day Ce^{141} and 11-day Nd^{147} have been

observed in a single crystal of $La_2Mg_3(NO_3)_{12} \cdot 24H_2O$ at 4.2°K. From the number of hfs lines the nuclear spins are $I(Ce^{141}) = 7/2$ and $I(Nd^{147}) = 5/2$. The magnetic hyperfine coupling constants are found to be $B(Ce^{141}) = 0.0126 \pm 0.0001\ cm^{-1}$, and $B(Nd^{147}) = 0.0237 \pm 0.0001\ cm^{-1}$. From these the nuclear magnetic moments are calculated to be $|\mu(Ce^{141})| = 0.89 \times 0.09$ nm, and $|\mu(Nd^{147})| = 0.542|\mu(Nd^{143})| = 0.56 \pm 0.06$ nm. These results are discussed in relation to those of the shell model and nuclear alignment experiments. (auth)

1621

SPIN AND MAGNETIC MOMENT OF Eu^{152} AND Eu^{154} BY PARAMAGNETIC RESONANCE. M. Abraham, R. Kedzie, and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 108, 58-9(1957) Oct. 1.

The microwave paramagnetic resonance hyperfine structures of 13-year Eu^{152} and 15-year Eu^{154} have been observed in a sample of Eu^{2+} which was incorporated in a KCl powder. From the number of hfs lines the spins were found to be $I(Eu^{152}) = 3$ and $I(Eu^{154}) = 3$. Neglecting hfs anomalies, from the ratios of the total hfs splitting these magnetic moment ratios were obtained: $|\mu(Eu^{154})|/|\mu(Eu^{153})| = 1.308 \pm 0.004$, $|\mu(Eu^{152})|/|\mu(Eu^{151})| = 0.5574 \pm 0.006$, $|\mu(Eu^{151})|/|\mu(Eu^{153})| = 2.264 \pm 0.006$. Using $\mu(Eu^{153}) \cong 1.6$ nm, it is found that $|\mu(Eu^{154})| \cong 2.1$ nm and $|\mu(Eu^{152})| \cong 2.0$ nm. These results are discussed in relation to the nuclear shell model. (auth)

1622

MAGNETIC MOMENT OF 72-DAY Co^{58} BY PARAMAGNETIC RESONANCE. W. Dobrov and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 108, 60-1(1957)

The microwave paramagnetic resonance hyperfine structure of 72-day Co^{58} has been observed at 20°K and 3-cm wavelength in a single crystal of $(Zn,Co)K_2(SO_4)_2 \cdot 6D_2O$. From the spacing of the hfs lines relative to those of Co^{59}, the magnetic moment $|\mu(Co^{58})| = 4.052 \pm 0.011$ nm is found, neglecting hfs anomalies. The pattern of lines is consistent with the previously known spin I = 2. (auth)

1623

NUCLEAR ENERGY LEVELS IN O^{16}, O^{18}, AND F^{19}. T. E. Young, G. C. Phillips, and R. R. Spencer (Rice Inst., Houston, Texas). Phys. Rev. 108, 72-4(1957) Oct. 1.

Thin targets of F^{19} and O^{18} have been bombarded with protons of approximately 5 Mev from the Rice Institute Van de Graaff accelerator. Excited states were observed at 1.344 ± 0.005, 1.458 ± 0.005, and 1.554 ± 0.005 Mev in F^{19}, and at 1.981 ± 0.004 Mev in O^{18}. Q values for the $F^{19}(p,\alpha)O^{16}$ reaction were determined to be 2.061 ± 0.015, 1.981 ± 0.008, 1.193 ± 0.008, 0.997 ± 0.008, and -0.763 ± 0.008 Mev. (auth)

1624

NUCLEAR DECAY OF Br^{84} AND THE LEVEL SCHEME IN Kr^{84}. Noah R. Johnson and G. D. O'Kelley (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 82-90(1957) Oct. 1.

The decay properties of fission product Br^{84} have been studied by scintillation methods. Its half life was found to be 31.80 ± 0.08 minutes. Gamma-ray spectra showed gamma rays of energy 0.27, 0.35, 0.43, 0.47, 0.52, 0.61, 0.74, 0.81, 0.879 ± 0.007, 1.01, 1.21, 1.47, 1.57, 1.74, 1.90 ± 0.02, 2.05, 2.17, 2.47 ± 0.03, 2.82, 3.03, 3.28, and 3.93 ± 0.03 Mev. Single-crystal and coincidence spectrometry established beta-ray groups at 4.71, 3.83, 2.80, 1.81, 1.39, and possibly 0.83 Mev. From these data a level scheme in Kr^{84} has been formulated with excited levels at 0.88, 1.90, 2.17, 2.36, 2.62, 2.71, 2.91, 3.35, 3.70, 3.91, and 4.18 Mev. The mass difference between the ground state of Br^{84} and Kr^{84} is represented by the 4.71-Mev beta ray which includes 32% of the beta-ray transitions. (auth)

1625

BETA SPECTRUM OF Th^{233}. B. J. Dropesky and L. M. Langer (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 90-1(1957) Oct. 1.

The beta spectrum of Th^{233} has been measured in a ring-focus solenoidal spectrometer and was not found to exhibit an anomalous shape, as had been previously reported. The end point is 1.23 ± 0.01 Mev, in agreement with the earlier value. It is shown that Th^{233} decays predominantly to the ground state of Pa^{233}. Half-life measurements yield a value of (22.4 ± 0.1) min for Th^{233}, somewhat shorter than the previously reported values. (auth)

1626

NUCLEAR ENERGY LEVELS IN Mn^{55}. M. Mazari, A. Sperduto, and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 103-5 (1957) Oct. 1.

Inelastically scattered protons from manganese targets bombarded with protons from an electrostatic accelerator have been studied with the high-resolution magnetic spectrograph. Forty-three excited states in Mn^{55} have been established in the region between the ground state and 4.0 Mev. The first five of these levels are at 0.127, 0.983, 1.289, 1.527, and 1.884 Mev. (auth)

1627

COULOMB EXCITATION OF KRYPTON. N. P. Heydenburg and G. F. Pieper (Carnegie Inst. of Washington) and C. E. Anderson (Yale Univ., New Haven, Conn.). Phys. Rev. 108, 106-7(1957) Oct. 1.

Using isotopically enriched samples, gamma-ray transitions were observed in krypton from Coulomb excitation by 6.6- and 6.1-Mev alpha particles. The following energies were obtained for the first excited 2^+ states; Kr^{78}, 450 kev; Kr^{80}, 620 kev; Kr^{82}, 780 kev; and Kr^{84}, 880 kev. No gamma radiation was observed for Kr^{83}. (auth)

1628

ASYMMETRY OF LOW-ENERGY POSITRONS FROM MUON DECAY. I. A. Pless, A. E. Brenner, and R. W. Williams (Massachusetts Inst. of Tech., Cambridge); R. Bizzarri and R. H. Hildebrand (Univ. of Chicago, Ill.); and R. H. Milburn, A. M. Shapiro, K. Strauch, J. C. Street, and L. A. Young (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 159-60(1957) Oct. 1.

An investigation of the angular asymmetry of low-energy positrons from the decay of polarized muons coming to rest in a propane bubble chamber is reported. The energy dependence of the asymmetry parimeter α is predicted by the two-component theory of the neutrino, while according to the four-component theory, with arbitrary parity-nonconserving interactions, this parameter can have a wide range of energy variations depending on the values of the interaction constants. Berley et al., have recently investigated the energy dependence of the asymmetry parameter for the upper half of the energy spectrum by an absorption technique and found approximate agreement with the prediction of the two-component theory. The results of the present work support this view. (A.C.)

1629

POLARIZATION OF POSITRONS FROM N^{13}: A MIXED TRANSITION. S. S. Hanna and R. S. Preston (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 160-1 (1957) Oct 1.

1630
NEUTRON CROSS SECTIONS. Donald J. Hughes. New York, Pergamon Press, 1957. 191p. $5.00.

A brief review of the most general properties of cross sections is given. Then, the theory of cross sections and nuclear structure is discussed. The specific techniques for measurement of cross sections and a consideration of the experimental results are presented, beginning with fast neutrons and continuing with resonance neutrons, resonances in fissionable materials, and concluding with thermal neutrons. In the discussions of experimental results, actual cross sections are presented for illustrative purposes only, as this volume is intended as a manual to assist in the understanding and use of compilations of cross section data, such as BNL-325. (M.H.R.)

Nuclear Reactors

1631 AECU-3320
Internuclear Co., Inc., Clayton, Mo.
PRELIMINARY DESIGN STUDY OF A FOOD IRRADIATION REACTOR. PHASE 2. July 1, 1956. 99p. (INTERNUC-3). $2.50(OTS).

A fully enriched light water cooled and moderated heterogeneous reactor core surrounded by a blanket of indium sulfate in light water was selected as the most promising reactor type for the operation of a 3000 lb/hr food irradiation pilot plant. The preliminary design study reported centers on a 3-foot high reactor core of twenty-four MTR type fuel assemblies. Versatility for irradiation of the various sizes and shapes of food items is provided by four radiators. In addition to a 2-lb can drum-type radiator, a drum-type radiator for 10-lb cans and two slab-type radiators for other sizes and shapes are provided. The more pertinent characteristics of the reference reactor-radiator complex are tabulated. (auth)

1632 CEA-650
France. Commissariat à l'Energie Atomique, Paris.
CONVECTION NATURELLE ENTRE PLAQUES PARALLELES VERTICALES. (Natural Convection Between Parallel Vertical Plates.) M. Robin and B. Schwab. Mar. 21, 1957. 30p.

In the thermal study of a "swimming-pool" type of pile, the flow of water between vertical plates of "combustible" material must be investigated. Therefore, starting from general equations of natural convection, we have determined the law of distribution of velocities, then that of temperatures, and finally the value of the Biot-Nusselt number, assuming steady-state conditions (both dynamic and thermal) and a constant heat flow at the surface. An abacus allows working power to be related to the average velocity and to the heating of the water which passes through the pile. (auth)

1633 CF-57-11-44
Oak Ridge National Lab., Tenn.
BIBLIOGRAPHY ON MAINTENANCE, MAINTENANCE EQUIPMENT AND CLOSURES. B. D. Draper. Nov. 4, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

1634 CRRP-708
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
DIGITAL COMPUTER SOLUTION OF THE TWO GROUP DIFFUSION EQUATIONS IN CARTESIAN OR CYLINDRICAL GEOMETRY WITH APPLICATION TO THE DATATRON. R. M. Pearce. June 24, 1957. 29p. (AECL-487).

An iteration method is described for solving the two-group diffusion equations on a square mesh using a digital computer. Either RZ or XY geometry can be used. All the two-group parameters can be varied at each mesh point. The computer obtains the value of ν necessary to bring the reactor critical in a given geometry and also the fast and slow fluxes. If the computer has IBM-card output a special output routine can be used to present the fluxes directly on a two-dimensional map using an IBM 407. The DATATRON program for the problem is given in an Appendix. With the DATATRON the number of space points is limited to 324 and one iteration takes 46 seconds. Flux distributions calculated for a swimming pool reactor are given as examples. The treatment of the adjoint diffusion equations follows closely that of the ordinary equation and is discussed in an appendix. (auth)

1635 HW-50337
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DESIGN BASIS FOR PRPR PROCESS TUBES. J. C. Fox and D. E. Johnson. May 24, 1957. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Design of Zircaloy-2 process tubes for the PRPR is described. Mechanical properties of vacuum annealed Zircaloy-2 are included. (W.L.H.)

1636 HW-52859 A2
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT [FOR] SEPTEMBER 1957. F. W. Albaugh, L. P. Bupp, and P. F. Gast. Oct. 10, 1957. 21p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported briefly in development of fuel elements, materials instrumentation, and mechanical equipment for the PRPR. (W.L.H.)

1637 IDO-16380
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
STANDARD PRACTICES FOR DESIGN OF MTR AND ETR SAFETY CIRCUITS. L. H. Jones, ed. Sept. 15, 1957. 33p. Contract AT(10-1)-205. $1.00(OTS).

Notes are given to assist the experimenter to design safety circuits compatible with the MTR and ETR control circuits and meet the requirements for safety to the experiment and the reactor. (auth)

1638 IDO-16395
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
INSTRUMENT AND ELECTRICAL STANDARD PRACTICES FOR MTR AND ETR. L. H. Jones, ed. Aug. 12, 1957. 54p. Contract AT(10-1)-205. $1.50(OTS).

A guide is given for the instrument engineer responsible for design of experiment instrumentation in the ETR and MTR. Both general and specific recommendations are made in an effort to guide the instrument engineer in designing a system compatible with the Phillips Petroleum Company safety, operating and maintenance requirements. (auth)

1639 IDO-16401
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
CALCULATION OF MTR FUEL CHARGES. H. L. McMurry, G. A. Cazier, and R. W. Goin. Sept. 27, 1957. 30p. Contract AT(10-1)-205. $1.00(OTS).

For economical operation of the MTR, mixtures of new and used fuel must be scheduled so that the required cycle time is met, and start-up after a scram, when Xe^{135} is present in the retained elements, is possible. The procedure described starts with an equation relating charge life

to the amount of uniformly distributed poison needed to keep a freshly loaded reactor just critical with all control rods out. This equation is adapted to give an expression for the life of a new fuel charge in terms of the known life of the preceding charge, and the changes in the initial fuel loading of the charges. It is then only necessary to compute the difference between the life of the new charge and the preceding one. Expressions for the distribution of retained fuel, and fuel re-cycled from the canal which will permit start-up after a scram when Xe^{135} is present in the retained elements, are also developed. (auth)

1640 IGR-TM/C-013
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
CO_2-COOLED THERMAL REACTORS — PRESSURE VESSELS; FACTORS IN THE SELECTION OF STEEL. A. B. McIntosh. Nov. 4, 1955. Decl. Sept. 13, 1957. 7p. (IGC-NPCC-MWP/P-1).

A discussion and some specifications of on-site fabrication of reactor pressure vessels are presented. (W.L.H.)

1641 IGR-TN/W-319
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
COOLANT GAGS FOR THE CALDER REACTOR. J. T. Wilson and M. Long. Mar. 28, 1956. 16p. (IGC-TRDC/P-161; IGC-TRDC/R-9).

Calder reactor coolant flow is regulated by means of discs or gags inserted in the bottom of the channels. Data are presented giving the relationship between gag size and pressure drop over a range of air flows for the three channel sizes in the Calder reactor. (auth)

1642 KAPL-M-PPS-1
Knolls Atomic Power Lab., Schenectady, N. Y.
CRITICAL MASSES OF HOMOGENEOUS WATER-MODERATED REACTORS. P. P. Szydlik. Aug. 12, 1957. 76p. Contract [W-31-109-eng-52]. $13.80(ph OTS); $4.80(mf OTS).

The critical mass density of U^{235} has been determined as a function of buckling for one region zirconium-water and stainless steel-water cores with and without B^{10}. This functional relationship enables results to be applied to any type of geometry. Using reflector savings derived from multigroup calculations the above results were applied to a limited range of cylindrical cores with water reflectors. The critical mass as a function of the volume of stainless steel, the difference between critical masses hot and cold for a particular composition, and reactivity coefficients for the uranium mass are also shown. (auth)

1643 LA-749
Los Alamos Scientific Lab., N. Mex.
POLYTHENE-25 CRITICAL ASSEMBLY AND NEUTRON DISTRIBUTION STUDIES. Hugh C. Paxton and G. A. Linenbarger. Sept. 30, 1949. Decl. Oct. 17, 1957. 51p. Contract [W-7405-eng-36]. $9.30(ph OTS); $3.60(mf OTS).

Delayed critical behavior was investigated for an array of ½ in. polythene cubes and U^{235} cubes of average composition $UF_{3.8}C_{1.9}$, in an 8 in. thick natural U tamper. The pseudosphere of critical size (2130 cm^3) contained 12.0 kg of 94.5% U. Rossi time-scale measurements gave $\alpha = -.36 \times 10^4$ at delayed critical. Activity distributions for S, Au, U^{235}, and U^{238} samples were obtained as a function of radius of the assembly. Appreciable local variations in neutron spectrum resulted from the inhomogeneity of the active array. (auth)

1644 LMFR/I-1
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
BISMUTH URANIUM FUEL SOLUTION. LMFR Information Sheet No. 1. A. M. Cocks and R. W. S. Carlson. Oct. 25, 1956. 20p.

The LMFR project team has studied various fuel solutions. The properties of a typical fuel solution, compiled from the references stated, are presented. (auth)

1645 NAA-SR-2005
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
LOW FREQUENCY INDUCTION HEATING DESIGN FOR THE ORGANIC MODERATED REACTOR EXPERIMENT. R. B. Hall and A. M. Elmore. Nov. 1, 1957. 30p. Contract AT(04-3)-88. $0.75(OTS).

To provide a low cost and reliable electrical preheating system for the Organic Moderated Reactor Experiment, a 60-cycle induction heating system was used. The low frequency induction design was based on analytical calculations for preheating carbon steel vessels and piping. Calculations involve the use of values obtained from magnetization curves and resistivity data for hollow cylindrical shapes. A critical analysis of the system's effectiveness is given. (auth)

1646 NP-6465
MSA Research Corp., Callery, Penna.
SIMULATION OF A MAJOR PIPE RUPTURE IN A PRESSURIZED WATER REACTOR TYPE PLANT. Technical Report No. 58. M. J. McGoff, S. J. Rodgers, and J. B. McDonough. Oct. 31, 1957. 21p. Contract NObs-65426.

Pressurized water at 550°F and 1100 psig containing the isotopes Na^{24}, I^{131}, and Y^{90} tracers was discharged into a vapor container to simulate a primary system rupture of a Pressurized Water Reactor type plant. Four runs were investigated to determine the degree of contaminant escape from the vapor container under conditions for minimum and maximum retention of the contaminants. Greater than 85% of the contaminants were retained in the vapor container for both cases; the magnitude of escape for all runs being low and of the order of 1% of the initial activity. In the 2 runs for minimum retention, greater than 85% of Na^{24}, 95% of I^{131}, and 60% of Y^{90} was accountable and for the maximum retention run, greater than 95% of Na^{24}, 96% of I^{131}, and 72% of Y^{90}. Trends show that the amount of activity escaping from the containers is related to the retainment conditions. A lesser amount of the soluble products and a greater amount of the insoluble products escaped during runs of maximum retention as apposed to runs of minimum retention. Pressure transients in the vapor container were of the order of 15 psig for blowdown rates of 4.7 lb water per sec and container temperature excursions were localized in areas near the pipe rupture. (auth)

1647 RDB(C)/TM-207
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
MECHANICAL TESTS ON BORON STEELS. F. P. Ellen. June 9, 1954. 9p. (TRDC/P-38).

The present design of control rods for the Thermal Reactor envisages the use of a suitable boron-containing material in tubular form, contained in a stainless steel tube. The material is required to have a reasonable impact strength, since failure of the lifting gear might result in a rod falling freely through a height of up to 30 ft before being brought to rest. The possibility of using a boron steel containing at least 2½% boron is being examined, and the present memorandum gives the results of tensile, impact, and hardness tests on a series of eight steels supplied in rolled bar form. (auth)

1648 RDB(C)/TM-225
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THERMAL REACTOR — PHYSICAL PROPERTIES OF MATERIALS OF CONSTRUCTION. I. P. Bell. Aug. 8, 1954. 5p.

Work has continued on the measurement of coefficients of thermal expansion and thermal conductivity of possible materials for use in thermal cartridges. Determinations of thermal expansion of Mg, Mg alloys Magnox C, A.M. 503, ZT 1, and ZRE 1, and Al alloys R.R. 57 and R.R. 58 were made. Some determinations of the thermal conductivity of Magnox C were carried out. The linear expansion coefficients of Magnox C (transverse and longitudinal cut specimens), A.M. 503, ZT 1, pure Mg, ZRE 1, R.R. 57, and R.R. 58 are shown. Little variation with temperature was observed in the values of thermal conductivity of Magnox C. A mean value of 0.31 cal. $cm.^{-1}$ $sec.^{-1}$ $°C^{-1}$ was obtained over the temperature range 200 to 420°C. (auth)

1649 RDB(R)/TN-43

Gt. Brit. Dept. of Atomic Energy. Industrial Group H. Q., Risley, Lancs, England.

TWO GROUP CORE CALCULATIONS FOR THE CALDER HALL THERMAL REACTORS. B. Cutts. June 2, 1954. 16p. (TRDC/P-42).

Detailed calculations of the nuclear properties of the core of a Calder Hall Thermal Reactor have been made. The zones of different channel size have been allowed for, but the Wigner gaps have been assumed to have a uniform size throughout the core. The different properties of graphite in the core and reflector and the different thicknesses and structures of the reflector sections around and at the ends of the core have been considered. The quantity and enrichment of U required to fill an outer zone in order that the pile shall just run at 180 Mw heat rating, when the inner zone is loaded with natural U, is given for inner zone radii from zero to 12 ft. (auth)

1650 RDB(R)/TN-55

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

A SURVEY OF LATTICE CALCULATIONS FOR GRAPHITE MODERATED GAS COOLED THERMAL REACTORS. B. Cutts, ed. Sept. 1955. 50p. (NPCC/RPWP/P-6).

The edited results of a wide range of lattice calculations are given which can be used in solving several kinds of reactor problems. In particular the critical size of a natural uranium reactor may be found or alternatively the critical enrichment for any given reactor size. The important lattice constants for an infinite reactor without poisoning are summarized. (auth)

1651 RDB(R)/TN-56

United Kingdom Atomic Energy Authority. Industrial Group, H. Q., Risley, Lancs, England.

CHANNEL RATINGS FOR THE CALDER HALL REACTORS INCLUDING THE EFFECT OF XENON POISONING ON THE RADIAL FLUX DISTRIBUTION. J. M. B. Lang. Sept. 1, 1955. 11p. (TRSWP/R-16).

The channel ratings to be expected in the Calder Hall Thermal Reactors from flux values based on normal two-group calculations are compared with those modified to allow for Xe poisoning. (auth)

1652 WAPD-MRP-69

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD JUNE 24, 1957 TO AUGUST 23, 1957. 78p. Contract AT-11-1-GEN-14. $2.25 (OTS).

A reactor plant simulation period was concluded and some significant results were obtained. The prototype multiport sampling valve was satisfactorily operated except for excessive leakage. The resistance thermometer seal problem was resolved. Satisfactory test methods were developed for testing BF_3 detector tubes. The initial assembly of the core cage was completed. A redesign of cluster retainers and nuts delayed completion of the cluster assemblies. A 7-week test at full flow and operating temperature and pressure was satisfactorily completed on the prototype cluster. A complete performance analysis was completed on Core-1. Fabrication of the test pressure vessel head was completed. Developmental studies of core support plates, control rod and shroud assemblies, and fuel and blanket assemblies for Core-2 were continued. Zircaloy-2 clad U–Zr seed alloys containing 6, 8, 10, and 12 wt. % U^{235} show no changes after 40% burnup. Modified welding parameters for oxide elements resulted in marked improvement in integrity. NH_4OH additions to coolant water do not adversely affect the corrosion resistance of Ag-base control rod alloys. The diffusion coefficient of oxygen in UO_2 was determined in the range 445 to 600°C. Core-1 seed cluster reactivity was measured. The measurements indicate a possible flux tilt might be minimized by proper seed cluster positioning. (For preceding period see WAPD-MRP-68.) (D.E.B.)

1653 WAPD-PWR-CP-3077

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

INFORMATION REQUIRED TO DEFINE CONTAMINATION STATUS OF PWR. W. T. Lindsay, Jr. [July 1957]. 12p. $3.30 (ph OTS); $2.40 (mf OTS).

1654 WAPD-PWR-RD-1-77

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

SIZING OF PWR CORE 1 BLANKET ORIFICES. P. A. Bickel and S. Cerni. [May 17, 1957]. 6p. $1.80 (ph OTS); $1.80 (mf OTS).

1655 WAPD-PWR-RD-1-126

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

RE-SIZING OF PWR CORE 1 BLANKET ORIFICES. P. A. Bickel and S. Cerni. [Aug. 8, 1957]. 4p. $1.80 (ph OTS); $1.80 (mf OTS).

The thermal, hydraulic, and nuclear bases for the design of the blanket orifice for the PWR are described. (W.L.H.)

1656 WAPD-T-542

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

A METHOD OF EVALUATING HEAT TRANSFER SIMULATION IN PRESSURIZED WATER REACTORS. R. P. Rose and S. O. Johnson. June 1957. 30p. $4.80 (ph OTS); $2.70 (mf OTS).

A method of evaluating the accuracy of heat transfer simulation, applicable to pressurized water reactors, is presented. Frequency-response techniques are used to compare differential equation and difference equation and difference equation representations, and to develop a general criterion for sectionalization of the core in the direction of coolant flow. The criterion is substantiated by transient analyses on an electronic analog computer. Typical reactor core parameters are employed in these analyses. (auth)

1657 WAPD-TM-82

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

NUMERICAL STUDIES OF REACTOR KINETIC EQUATION PARAMETERS. Marvin J. Abrams. Aug. 22, 1957. 50p. Contract AT-11-1-GEN-14. $7.80 (ph OTS); $3.30 (mf OTS).

A simple one iteration scheme for calculating the effective delayed neutron fraction is found to compare well with the perturbation method for a bare core. This scheme is then applied to a variety of multiregion cores. The prompt neutron lifetime is also calculated for these

cases by the eigenvalue perturbation method. The bare core approximation for both delayed fraction and prompt lifetime is also calculated for each case and results compared with those from the iteration technique. (auth)

1658 WKNL-64
Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
PRELIMINARY DESIGN OF A 45 MW ENGINEERING TEST REACTOR FOR THE CONNECTICUT AIRCRAFT NUCLEAR ENGINE LABORATORY. Karl H. Puechl. July 19, 1956. 79p. For Pratt and Whitney Aircraft Div. Contract AF33(038)-27341, Subcontract 967610.

This report supersedes WKNL-58.

A preliminary engineering study of a low-temperature, high-flux test reactor, operating at 45 Mw, to be used for in-core irradiation of experimental loops is presented. This reactor, water-moderated and -cooled and Be-reflected, uses enriched U–Al alloy fuel elements. It is similar to but simpler than the Materials Testing Reactor and uses Engineering Test Reactor fuel elements. Its initial loading requires 5.2 kg of U^{235}, its life at full power is 21 days, and its average burnout at end of life is 22.5%. (M.H.R.)

1659 TID-5302(Rev.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR FUEL ELEMENT SPECIFICATIONS. [1957]. 73p. $2.00(OTS).

Specifications are given for the manufacture of PWR core 1 blanket sampling tube assemblies, blanket shell assemblies, natural UO_2 fuel rods, penetrant surface inspection of Zircaloy and Hf reactor components by the pentrex method, loading of UO_2 fuel components, mechanical agglomerization of natural UO_2 powder, sintering of natural UO_2 fuel compacts, grinding of natural UO_2 fuel components, testing UO_2 fuel components, measuring wall thickness of Zircaloy-2 tubes by the ultrasonic resonance method, eddy-current testing of Zircaloy-2 tubes, fusion welding end closures of UO_2 fuel rods, radiographic inspection of rod end closure welds, and leak testing of components. (W.L.H.)

1660 TID-7532(Pt. 1)
Division of Reactor Development, AEC.
REACTOR CONTROL MEETING HELD IN LOS ANGELES, MARCH 6-8, 1957. Oct. 1957. 245p. $6.00(OTS).

Papers are included on the reactor control meeting summary remarks, a review of methods used in control rod analysis for reactor design at Bettis, formulas for control rod worth in thermal reactors, half-group theories for control rods, variational calculation of control rod absorption area, thin regions in diffusion theory calculations, flux distribution for a finite cylindrical bare homogeneous thermal reactor with a partially inserted control rod, dependence of control rod worth on reactor temperature and fuel exposure, multiple control rod calculations, heterogeneous reactor critical conditions using the small source theory, control rod worth studies on seed and blanket reactors, limitations of scram transient calibrations, APPR-1 control rod experiments and calculations, APPR control rods–theory and experiment, control rod worths vs. temperature in LAPRE I, effects of rod shape on control worth, lattice experiments on thin black control rods, theory and experiments on rods containing rare earth metals, an empirical determination of fast absorption constants of control rods, the control of fast reactors, the general application of burnable poisons, experiments with control rods and voids in a pool type reactor, investigation of absorbing membranes in slab reactors, chemical control experience in boiling reactors, central control rod calculations for SPERT reactors, some control rod studies at the Materials Testing Reactor, a calculation of the effect of voids in large boiling reactors, reactor control work at General Electric APED. (M.H.R.)

1661 YAEC-27
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
THERMAL STABILITY OF THE YANKEE NUCLEAR POWER PLANT. C. F. Obermesser. May 15, 1957. 44p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $7.80(ph OTS); $3.30(mf OTS).

Results of a preliminary study of the thermal stability of the Yankee Atomic Electric Company Pressurized Water Reactor Power Plant are given. The study was made by using the servo method of analysis. The system is considered on a thermal basis for stability, and only the effects of the various components in terms of temperature are considered. In order to get a more accurate representation of the reactor thermal system, it is divided into three sections in the direction of the main coolant flow, and the principle of linear superposition is used in the analysis. The stability is determined by the magnitude of the phase margin at the frequency where the gain is 1.0 or 0 db. Customary stability criteria require only 35° phase margin, and, for this particular study, the phase margin is found to be approximately 86°. Subject to the limitations of the simplifying assumptions in this analysis, it is therefore seen that the Yankee Plant exhibits an unusually large degree of stability when analyzed on a thermal basis. (auth)

1662
NUCLEAR POWER ENGINEERING. Henry C. Schwenk and Robert H. Shannon. New York, McGraw-Hill Book Company, Inc., 1957. 335p.

The basic facts of the physics, design, materials, economics, and operation of nuclear power plants are covered. Sections are included on reactor systems and auxiliaries, reactor loop components, plant location and safety, heat transfer, and power cycle studies. Information is given in the appendices on reactor programs, pressurized-water reactors, boiling-water reactor plants, sodium-graphite reactors, fast breeders, homogeneous reactors, and an abstract of the ASME "A Glossary of Terms in Nuclear Science and Technology." (M.H.R.)

1663
HINKLEY POINT. ADVANCED DESIGN OF WORLD'S FIRST 500,000 KW NUCLEAR STATION. Atomics 8, 377-80(1957) Oct.

Two gas-cooled, graphite moderated reactors are proposed, similar to the Calder Hall reactors but having much greater power for the same dimensions. The gas coolant is CO_2. Six heat exchangers will be associated with each of the two reactors. A labelled cutaway drawing of one of the nuclear reactor groups is given. (M.H.R.)

1664
THE HALDEN PROJECT. F. R. Paulsen. Atomics 8, 381-2(1957) Oct.

The design, engineering features, and progress on the Halden Boiling Water Reactor Project at the JENER establishment in Norway are reported. The circulation system is diagramed, showing position of the core, moderator system, and steam manifold. (M.H.R.)

1665
REACTIVITY CHANGES. P. A. Egelstaff (A.E.R.E., Harwell). Atomics 8, 391-4(1957) Oct.

A general discussion of reactivity changes is given. These changes are discussed in three classes: the long term variations caused by such factors as fuel burnup,

the changes correlated with the temperature of the system, and fluctuations due to the disposition of neutron absorbers. Plots of reactivity change caused by these variations are given. (M.H.R.)

1666
ECONOMICS OF POWER REACTORS. W. Oswald. Atomics 8, 395-8(1957) Oct.

The economics of power reactors is discussed with special reference to the natural U graphite moderated type. Emphasis is given to the economics of British power reactors with a view to selling them to other countries. (M.H.R.)

1667
DOUNREAY'S MATERIALS TESTING REACTOR. Atomics 8, 404-5(1957) Oct.

This reactor is briefly described. The containment vessel and irradiation testing program are discussed. (M.H.R.)

1668
DEVELOPMENTS IN THE FIELD OF POWER REACTORS. A. J. Salmon (Associated Electrical Industries, Ltd., Aldermaston, Berkshire, Eng.). Atomkern Energie 2, 288-94(1957) Aug.-Sept.

The particular problems which face reactor designers are briefly described and discussed and the present state of nuclear power reactor development throughout the world is surveyed. (M.H.R.)

1669
SOME ASPECTS OF LIGHT WATER MODERATED REACTORS FOR POWER APPLICATIONS. T. J. Connolly (Univ. of California, Los Angeles). Atomkern Energie 2, 295-8(1957) Aug.-Sept.

As the propulsion unit in a nuclear powered ship, a hydrogen-moderated, heterogeneous reactor, using slightly enriched fuel would have a number of advantages. Such types as the pressurized water reactor, boiling water reactor, organic moderated reactor, and solid hydride-moderated, gas-cooled reactor are included in this classification. Some results of studies conducted by the Ship Group at the Institutt for Atomenergi for the purpose of determining the most favorable range of conditions on which to base a detailed engineering study are given. (M.H.R.)

1670
SAFETY CONDITIONS ON BOARD IN A NUCLEAR ENERGY OPERATED TANKER. André Ertaud. Atomkern Energie 2, 299-303(1957) Aug.-Sept. (In German)

Discussions are included on radioactive hazards from reactors, protection against explosions or bursting of the active part in the enclosing tanks, the inherent stability of the reactors, safety at shutdown, safety of control mechanisms, instability of the platform and inertial stress, operating problems, radiation hazards in an accident, hazards at sea, and fuel exchange. (M.H.R.)

1671
THE HANDLING OF FUEL ELEMENTS: A KEY PROBLEM OF A TANKER WITH NUCLEAR PROPULSION. M. Virnot. Atomkern Energie 2, 303-4(1957) Aug.-Sept. (In German)

1672
THE WORK OF THE ATOMIC ENERGY COMMITTEE FOR THE FOUNDATION OF SHIPBUILDING RESEARCH IN SWEDEN. Lennart Swenson. Atomkern Energie 2, 305-6 (1957) Aug.-Sept. (In German)

1673
THE ACTIVITY OF THE JAPANESE RESEARCH COMMITTEE FOR THE USE OF ATOMIC PROPULSION IN NAVIGATION. Konsul S. Harada and Makiura. Atomkern Energie 2, 306(1957) Aug.-Sept. (In German)

1674
VARIOUS PROBLEMS OF REACTOR COOLING. H. Benzler. Atomkern Energie 2, 307-10(1957) Aug.-Sept. (In German)

A mathematical analysis of reactor cooling problems is given. (M.H.R.)

1675
THE AUTOMATIC CONTROL OF THE KARLSRUHE RESEARCH REACTOR FR 2. P. Dosch. Atomkern Energie 2, 316-19(1957) Aug.-Sept. (In German)

1676
ELECTRONIC COMPUTING IN REACTOR CONSTRUCTION. P. St. Pütter. Atomkern Energie 2, 319-20(1957) Aug.-Sept. (In German)

1677
PROBLEMS OF HOMOGENEOUS FLUID REACTORS—AN EXAMPLE OF THE SOLUTION REACTOR AND THE SLURRY BOILING REACTOR. Manfred Siebker. Atomkern Energie 2, 321-8(1957) Aug.-Sept. (In German)

Graphs are presented on Xe poisoning as a function of time after shutdown, unreflected critical mass and radius as a function of concentration at different enrichments, U^{235} enrichment in UO_2SO_4 solution for $K_{eff} = 1.02$ in spherical reactors without reflectors, phase diagrams for the $UO_2SO_4-H_2O$ system, and hydrogen buildup in $UO_2SO_4-H_2O$ solutions. (M.H.R.)

1678
CAN REACTORS BE RADIATION SAFE? P. R. Arendt. Atomkern Energie 2, 335-8(1957) Aug.-Sept. (In German)

1679
REACTOR-SITE SELECTION. C. H. Topping (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 1-8(1956).

An efficient systematic method has been worked out for the selection of commercial plant sites for the chemical industry. The steps involved are described together with the type of data normally required. The typical procedure was readily expanded to fit the search for the reactor site which later became the Savannah River Plant. The account of this search is used to illustrate the significant factors in reactor-site selection. (auth)

1680
THE FORD NUCLEAR REACTOR AND PHOENIX MEMORIAL LABORATORY. Russell B. Mesler, William K. Luckow, and Henry J. Gomberg (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 9-14(1956).

The University of Michigan has established the Michigan-Memorial-Phoenix Project to pursue the peacetime applications of atomic energy. As a part of this project the $1,000,000 Ford nuclear reactor and the $1,500,000 Phoenix Memorial Laboratory have been planned and built. The experimental facilities of these two installations are described. (auth)

1681
THE MATERIALS TESTING REACTOR OPERATIONAL BEHAVIOR. John R. Huffman (Phillips Petroleum Co., Idaho Falls, Idaho). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 27-35(1956).

The Materials Testing Reactor, built in 1951, has been operating successfully at 30,000 kw for over three years. It provides for the study of the behavior of reactor components and materials of construction in thermal neutron fluxes of greater than 2×10^{14} neutrons/(sq cm)(sec). Interesting features of its operational behavior are de-

scribed. These include the Xe problem, the neutron-flux distribution, the heat pattern, and the fuel loadings for various operating cycles. (auth)

1682

THE ENGINEERING DESIGN OF EBR-II. L. J. Koch (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 37-47(1956).

The EBR-II is one of the five prototype industrial power reactors selected by the A.E.C. for development. A plutonium-fueled, unmoderated, sodium-cooled reactor with a power rating of 60,000 kw of heat, it is a complete plant including the reactor, the steam-electric power plant, and an integral fuel-reprocessing and -fabrication facility. The plant includes engineering features which are believed to be applicable to large central-station power plants and employs system components large enough to be directly applicable to large central-station power plants and employs system components large enough to be directly applicable to large plants. (auth)

1683

EFFECTS OF COOLANT-FLOW ORIFICING AND MONITORING ON SAFE PILE POWER. Michael Markels, Jr. (Columbia Univ., New York). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 73-85(1956).

The general heat transfer characteristics of a liquid-cooled, multichanneled reactor are introduced along with the most important types of malfunction which might be expected. The effect of inlet orificing on flow instability is discussed and the important factors for the case of local-boiling burnout are introduced. Temperature and pressure monitoring of the coolant flow are discussed and monitor-trip equations are derived. The orifice and monitor approach to maximum safe-pile power are contrasted, showing the orifice to be limited in scope but surer in operation, while the monitor is wider in scope but inherently less reliable. (auth)

1684

WATER TECHNOLOGY FOR PRIMARY SYSTEMS IN WATER-COOLED POWER REACTORS. D. M. Wroughton, J. M. Seamon, and H. F. Beeghly (Westinghouse Electric Corp., Pittsburgh). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 87-97(1956).

Discussions are included on preparation of make-up water, corrosion problems, fouling problems, radioactivation problems, experience in operating systems, and use of carbon steel in reactor systems. (M.H.R.)

1685

ECONOMICS OF A FAST-REACTOR REPROCESSING CYCLE. Robert W. Kupp (Vitro Corp. of America, New York and Atomic Power Development Associates, Inc., Detroit, Mich.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 143-6(1956).

Fast-neutron-breeder reactors have inherently a relatively short core fuel cycle. This short fuel cycle together with long decay times necessary for direct fabrication and cooling before processing entails a very significant fuel-inventory charge. Pyrometallurgical reprocessing schemes combined with a remote fabrication operation hold promise of a minimum-cost cycle for fast-reactor reprocessing. The total cycle cost of a large installation may be about one half to three fourths that of an aqueous plant cycle. (auth)

1686

THE SPECIAL TECHNICAL AND ECONOMICAL ASPECTS OF SMALL NUCLEAR POWER PACKAGES. Tibor F. Nagey and William W. Wachtl (Glenn L. Martin Co., Baltimore, Md.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 147-51(1956).

Small reactor power packages ranging up to 20,000 kw. of electrical output will become increasingly important in the supplying of power to many small and yet-to-be-industrialized areas of the world. Many reactor types have been studied for this application from both a technical and an economic standpoint. The economics of any small reactor-system design is evaluated and the proportionate importance of various design factors is indicated. It is inferred that from an economic and system-simplicity standpoint, the development of a gas-cycle reactor is paramount to the development of a small-reactor industry. (auth)

1687

MEASUREMENT OF NEUTRON FLUX IN CRITICAL ASSEMBLIES. J. L. Crandall (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 159-63(1956).

Methods of measuring thermal-neutron-flux distributions in experimental reactors are considered with particular reference to the techniques in use at the Savannah River Laboratory. Such measurements are made to determine reactor lattice constants, to evaluate neutron economy, and to investigate flux perturbations introduced by the movement of control rods. Measuring techniques may be divided into instrumental and activation methods. An instrumental technique which has found wide application at the Savannah River Laboratory uses traveling monitors. These are neutron-sensitive chambers that can be moved through the reactor to determine the flux as a function of chamber position. Unusual activation techniques in use at this site are the counting of activity induced on a wire moving in the moderator and the counting of fission activity on removable sections of the fuel. (auth)

1688

MEASUREMENT OF LATTICE CONSTANTS IN A TWO-REGION CRITICAL ASSEMBLY. B. M. Carmichael and G. F. O'Neill (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 173-5(1956).

The nuclear properties of a new-pile lattice are usually studied either in a subcritical exponential assembly or in a critical mock-up of the lattice. An additional method has been developed at the Savannah River Laboratory that combines the small sample size of the exponential experiments with the speed and accuracy of the criticality measurements. A sample of test lattice, occupying only a small fraction of the pile volume, is put inside a critical assembly which uses a liquid moderator. Then the effect of the test section on the assembly is measured in terms of the height to which the moderator has to be raised to bring the assembly to criticality. If the critical moderator heights are first calibrated in terms of test lattices of known bucklings, the buckling B^2 of an unknown lattice can easily be determined from the critical height and the calibration curve. To obtain the multiplication constant, k_∞, for the test lattice the migration area M^2 is measured from flux traverses in the lattice and combined with the measured buckling. (auth)

1689

A SUBCRITICAL PILE FOR RAPID REACTIVITY MEASUREMENTS. R. C. Axtmann, Gerhard Dessauer, and T. F. Parkinson (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 165-71(1956).

Some reactors contain a very large number of identical fuel elements, and each fuel element is usually tested for a number of possible defects before being charged into the reactor. The reactivity of the element is measured in a test pile by period or by control-rod compensation. A disadvantage of this method is that it takes about 15 min.

to measure a period or to determine the critical position of the control rod with sufficient accuracy. The nuclear test gauge (NTG) eliminates this delay while maintaining the required sensitivity. It is a subcritical pile of small critical mass. A change of reactivity, caused by the replacement of one sample by another, is accompanied by instantaneous readjustment of the neutron multiplication. The NTG contains a strong neutron source and operates at a multiplication of approximately one hundred. This is high enough for accurate differentiation between acceptable and unacceptable fuel elements and low enough for quick response to changes in successive samples. Among the design features that are described are a horizontal through-hole that can accommodate a large variety of reactor elements, a safety valve that dumps the light-water moderator within 15 sec., and a difference circuit that plots the reactivity of the test samples on a recorder chart. (auth)

1690

EXPONENTIAL MEASUREMENTS IN HEAVY-WATER SYSTEMS. O. A. Towler, Jr. and J. W. Wade (E. I. du Pont de Nemours & Co., Inc., Aiken, S. C.). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 177-81(1956).

In exponential techniques presently employed at the Savannah River Laboratory, a number of corrections characteristic of heavy-water lattices are discussed, particularly the production of photoneutrons by gamma rays from the source and the leakage of fast neutrons into the tank. New instrumentation for exponentials includes a remotely controlled traveling ionization chamber and an integrating chamber. A method of curve fitting is presented that permits the calculation of bucklings on an IBM machine. (auth)

1691

SERVO-MECHANISMS IN NUCLEAR REACTORS. Pierre Bonnaure. d'Electronique No. 115, (1956) June. (In French)

1692

INSTRUMENTATION FOR NUCLEAR REACTORS. Denis Taylor. die atom wirtschaft 2, 308-12(1957) Oct. (In German)

1693

CONTROL OF NUCLEAR REACTORS. J. Walker (AERE, Harwell, Eng.). die atom wirtschaft 2, 313-16(1957) Oct. (In German)

1694

DELAYED NEUTRONS IMPORTANCE IN REACTOR TRANSFER FUNCTION. S. Barabaschi (CISE Labs., Milano). Energia nucleare (Milan) 4, 399-404(1957) Oct.

Some results obtained in trying to determine the effect of the actual percentage of the delayed neutrons in the transfer function of a reactor with a constant excess of reactivity are outlined briefly. It is possible to evaluate such an effect by considering an equivalent reactor at constant power level with an excess of reactivity $\Delta K = 0$, but with different delayed neutron constants. (auth)

1695

CONTRIBUTION TO THE THEORY OF HALF-INTERMEDIATE HALF-THERMAL REACTORS WITH Pu-ENRICHMENT. H. J. Brüchner and H. Kornbichler. J. Nuclear Energy 5, 362-72(1957). (In German)

How resonance absorption of neutrons in Pu^{239}, Pu^{240}, and Pu^{241} affects the properties of a nuclear reactor whose uranium fuel elements have a slight plutonium enrichment was studied. The improvement of the neutron balance and the ensuing increase of the multiplication constant k because of epithermal fission of Pu^{239} and Pu^{241} was derived. Furthermore, the time-variation of the fuel composition was discussed, making due allowance for epithermal build-up and burn-up of U^{238} and the Pu isotopes. (auth)

1696

HINKLEY POINT. ANTICIPATED 500 MW OUTPUT. Nuclear Eng. 2, 423-6(1957) Oct.

A description of the Hinkley Point station is given. (W.L.H.)

1697

SOME QUESTIONS CONCERNING THE OPERATION OF A NUCLEAR POWER STATION. A. N. Grigoriants. J. Nuclear Energy 5, 377-88(1957).

A discussion is presented of the experience gained in operating the nuclear electric power station of the U.S.S.R. (auth)

1698

THE RUSSIAN 420 MW POWER STATION. PRESSURIZED WATER DESIGN FAVOURED BY U.S.S.R. Nuclear Eng. 2, 431-6(1957) Oct.

A description is given of a 420 Mw power station which constitutes one of the nuclear power supply targets in the Sixth Five-Year Plan for the development of the national economy in the USSR. (auth)

1699

CIVIL ENGINEERING AT BRADWELL. A. Houghton Brown (Nuclear Power Plant Co., Ltd.). Nuclear Power 2, 403-6(1957) Oct.

Civil engineering problems of the Bradwell power station are summarized. Among these are the problems concerned with the clay subsoil, the site being below high tide level, and the CEA requirement that the contractors must submit a lump sum tender for complete stations to their own designs. Some details of the reactor buildings, the turbine house, and the circulating water systems are given. (M.H.R.)

1700

BRADWELL REACTOR VESSELS. DESIGN, FABRICATION AND ERECTION PROBLEMS. R. F. Bishop (Whessoe, Ltd.). Nuclear Power 2, 406-9(1957) Oct.

Problems involved in the selection of a steel, which must be suitable for site-welding in thick plate form and for withstanding the high temperature working conditions, are summarized. Forming the plates, site prefabrication, erection inside the vault, and stress relieving and pressure testing are described also. (M.H.R.)

1701

BRADWELL NUCLEAR POWER STATION. Nuclear Power 2, 410-13(1957) Oct.

A detailed description of the Bradwell Nuclear Power Station is given. The principal nuclear and engineering data, the charging system, the safety features, shielding, power generation system, and control system details are summarized. A 2 by 3 ft. colored cutaway drawing of the installation is included. (M.H.R.)

1702

NUCLEAR PHYSICS AT BRADWELL. SOME DESIGN ASPECTS. S. E. Lewis (Nuclear Power Plant Co., Ltd.). Nuclear Power 2, 414-15(1957) Oct.

Some design aspects of the nuclear physics at Bradwell are summarized, among these are: economic utilization studies, increasing mean irradiation, reactivity losses, and flux flattening. (M.H.R.)

1703

BRADWELL BOILERS. THE DESIGN PROBLEMS AND SOME SOLUTIONS. F. Carr (Nuclear Power Plant Co., Ltd.). Nuclear Power 2, 416-19(1957) Oct.

The design problems and solutions involved in the Bradwell boilers are summarized in the following topics: boiler losses, the single pressure cycle, the approach

temperature, design variables, the optimum matrix, research, and development of extended surfaces. Illustrations included are a vertical section of the boiler system, boiler heat transfer losses vs. gas temperatures, power loss plotted against matrix surface, tabulated heat transfer power loss in a single-pressure cycle, and a photograph of the integral-finned heat-transfer tubing. (M.H.R.)

1704
EXTENDED SURFACE BOILER TUBING. DEVELOPMENT OF INTEGRAL FINNED STEEL PIPE FOR BRADWELL AND OTHER POWER STATIONS. F. Howarth (Imperial Chemical Industries, Ltd.). Nuclear Power 2, 420-1(1957) Oct.

Discussion is included on the following topics: the mild steel used, stock materials for finning, the rotary cold extrusion process, fins formed in one pass, and size specifications. (M.H.R.)

1705
BRADWELL TURBO-ALTERNATORS. AUXILIARY TURBINE SETS AND GAS CIRCULATORS. Nuclear Power 2, 422-3(1957) Oct.

1706
LAYOUT AND SERVICES. SOME BRADWELL CONSIDERATIONS. T. Andrews (Nuclear Power Plant Co., Ltd.). Nuclear Power 2, 424-5(1957) Oct.

1707
BOILERMAKING FOR BRADWELL. UNORTHODOX TRANSPORT ARRANGEMENTS. Nuclear Power 2, 426 (1957) Oct.

1708
SPECIAL LUBRICANTS FOR BRADWELL. Nuclear Power 2, 427-8(1957) Oct.

The work at Shell's Co^{60} facility on radiation effects on oils is reported, along with the development of special radiation resistant lubricants. (M.H.R.)

1709
BRADWELL. INDUSTRY'S CONTRIBUTION. Nuclear Power 2, 429-37(1957) Oct.

The details of some sub-contracts are given, among these are the ones for reactor standpipes, thermocouples, wired television, concrete curing, alloy steel forgings, crane motors, indicating temperature controllers, exciter air filters, gas flow measurement, water strainers, Goliath crane, pipe couplings, rotary water strainers, modulating valves, storage batteries, concrete fixings, chlorination plant, water valves rotor forgings, reduction gearing, circulator water treatment, duct hangers, condenser tubing, demineralization plant, air compressors for test, shield cooling fans, motor control gear, temporary buildings, turning rolls for boiler making, circulator motors, gas driers, bolt heating, oil seal valves, boiler circulation pumps, forged tube bends, main gas valves, instrument air compressors, hydraulic couplings, and neutron source tubes. (M.H.R.)

1710
IMPULSE APPROXIMATION FOR STRIPPING REACTIONS. W. Tobocman (Case Inst. of Tech., Cleveland, Ohio). Phys. Rev. 108, 74-6(1957) Oct. 1.

The impulse approximation expansion is applied to stripping processes. The first term of the impulse expansion for the stripping problem is identical with the first term of the Born expansion. It is suggested that the impulse approximation argument may provide a better justification for the usual treatment of stripping and pickup reactions than does the Born approximation argument. (auth)

Nuclear Transformation

1711
THE PRODUCTION OF THRESHOLD REACTIONS IN A GRAPHITE REACTOR. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/189. C. E. Mellish, J. A. Payne, and R. L. Otlet. London, Pergamon Press, Ltd., 1957. 13p.

The reaction Ni^{58} (n,p) Co^{58} has been used to monitor the flux of fast fission neutrons in the Harwell reactor BEPO in a series of different positions in the reactor, making assumptions about the energy spectrum of the flux. The ratio of fast to slow flux is plotted through the reactor, and this gives the preferred positions for producing threshold reactions and the preferred positions for eliminating them as far as possible. The importance of this elimination in some radioactivation analyses is pointed out. The occurrence of "exothermic" (n,p) reactions such as N^{14} (n,p) C^{14} and Cl^{35} (n,p) S^{35} is discussed. Cross-sections are presented for a number of (n,p) reactions on elements ranging from Ti to Tl in the Periodic Table, and for some (n,α) reactions on elements from Ti to Cs. Where the product isotope can also be formed by neutron capture in impurity a method is devised to correct for any impurity present. The cross-sections measured are compared with those predicted by theory. (auth)

1712
AN ATTEMPT TO OBSERVE THE CAPTURE OF REACTOR NEUTRINOS IN CHLORINE-37. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/223. Raymond Davis, Jr. London, Pergamon Press, Ltd., 1957. 7p.

An experiment has been performed in which 3800 liters of CCl_4 have been irradiated adjacent to a nuclear reactor in an attempt to induce the production of radioactive $argon^{37}$ from neutrino capture in $chlorine^{37}$. The $argon^{37}$ was removed by sweeping with helium and counted in a small low level counter. Auxiliary experiments carried out away from the reactor show that background cosmic radiation and fast neutrons from the reactor were too small to account for the activity observed in the experiment. The observed neutrino capture cross section was less or equal to 1.1×10^{-45} cm^2. This value is to be compared to a theoretical cross section of 2.6×10^{-45} cm^2 if neutrinos and antineutrinos are identical. According to recent theoretical ideas based on parity-non-conservation experiments, a nuclear reactor may emit both neutrinos and antineutrinos. If this were the case the reaction observed would only be induced by the neutrinos. The cross section should then range from zero to the theoretical value given above depending upon the ratio of neutrinos and antineutrinos emitted by the reactor. (auth)

1713
SECONDARY NUCLEAR REACTIONS IN BOMBARDMENT OF TIN BY FAST PROTONS. M. Ya. Kuznetsova, V. N. Mekhedov, and V. A. Khalkin. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. 1957. (In Russian).

Radiochemical analysis was used in the investigation of Te and I production from Sn bombarded by 170 to 660 Mev protons. Cross sections for α particle and Li nucleus secondary capture reactions at 660 Mev were found to be 10×10^{-30} cm^2 and 1.6×10^{-30} cm^2, respectively. The cross sections were in good agreement with the results obtained

by other authors for Cu, Sn, and Pb, but disagreed with the data offered by L. Marquez and I. Perlman, Phys. Rev. 81, 953(1951). (tr-auth)

1714

POSITRONS IN In^{114} RADIATION. B. S. Dzhelepov, O. E. Kraft, and V. B. Zhinkina (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 978-84(1957) July. (In Russian)

Investigations were made of the competing $\beta^+ - \beta^-$ decay in In^{114}. The electronic decay of In^{114} results in a nucleus with proton completed shell Sn^{114}. The $\beta^+ - \beta^-$ decay was studied to determine the factors affecting the degree of forbiddenness in β transitions. (R.V.J.)

1715

INVESTIGATION OF THE (α,n) REACTION IN OXYGEN. I. A. Serdyukova, A. G. Khabakhpashev and E. M. Tsenter (Moscow Engineering-Physics Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1017-19(1957) July. (In Russian)

Studies were made to determine which isotope (O^{17} or O^{18}) has a larger yield of neutrons and to determine the cross section for it. The γ radiation accompanying the reaction was also investigated. Results of measurements showed that the thick target of O^{18} yields 31 neutrons per 10^8 α particles, and the cross sections of the reaction $O^{18}(\alpha,n)Ne^{21}$ is considerably larger than the cross section of any other element except Be. (R.V.J.)

1716

PHOTOPROTONS FROM ^{100}Mo. F. Ferrero, A. O. Hanson, R. Malvano, and C. Tribuno. Nuovo cimento (10) 6, 585-91 (1957) Sept.

An extension of the measurements of the photoproton yield from Mo^{100} up to an energy of 30 Mev is given. It is found a rather large (γ, p) cross section at a higher energy than that for the (γ, n) reaction. A discussion is given of this evidence implying that the initial states of the protons involved in these transitions are different than those for the neutron or proton states responsible for the giant resonance in the (γ, n) reaction. (auth)

1717

PHOTOPRODUCTION PROCESSES AND DISPERSION RELATIONS. A. A. Logunov and A. N. Tavkhelidze (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.) and L. D. Solovyov (Moscow State Univ., U.S.S.R.). Nuclear Phys. 4, 427-42(1957) Sept.

Dispersion relations for photoproduction of π mesons on nucleons are obtained. The role of bound states is discussed in connection with an analysis of the unobservable energy region. The matrix structure of the photoproduction amplitude is considered. The dispersion relations are presented in a form convenient for phase shift analysis. (auth)

1718

INTERACTIONS OF 28-Mev PROTONS WITH HELIUM-4. Arthur F. Wickersham, Jr. (Univ. of California, Berkeley). Phys. Rev. 107, 1050-5(1957) Aug. 15.

When He^4 is bombarded with 28-Mev protons the dominant reaction is elastic scattering, exhibiting a strong peak in the forward direction and a slight rise in the backward direction. The dominant inelastic reaction is the inverse Butler or pickup deuteron process. The two remaining inelastic reactions observed, $He^4(p,2p)H^3$ and $He^4(p,pn)He^3$, have cross sections of 8.9 ± 1.0 and 4.8 ± 1.3 mb, respectively. These are an order of magnitude or more smaller than the cross sections of the dominant processes. Of the remaining possible reactions—(p,pd), (p,n2p), (p,pγ)—only the last was energetically possible at the beam energy used. It was not observed. This indicates a lack of evidence for an excited level that decays principally by γ-ray emission; it also indicates that the inverse photodisintegration process, suggested by Flowers and Mandl, has too small a cross section to contribute in this energy region. The rest-frame momentum spectrum of protons from the $He^4(p,2p)H^3$ reaction shows no evidence of an excited level in He^4 in the energy region explored. (auth)

1719

ANGULAR DISTRIBUTIONS OF NEUTRONS FROM $Al^{27}(d,n)Si^{28}$. A. G. Rubin (Boston Univ., Mass.). Phys. Rev. 108, 62-8(1957) Oct. 1.

By using the method of proton recoils in nuclear emulsions angular distributions of neutrons emitted to low-lying states of Si^{28} in the reaction $Al^{27}(d,n)Si^{28}$ have been obtained at deuteron energies of 2.16 and 6.00 Mev. As might be expected, the angular distributions obtained at $E_d = 2.16$ Mev show considerable deviations from the predictions of the simple Butler stripping theory. The angular distributions obtained at $E_d = 6.00$ Mev have been analyzed by means of the Butler theory to obtain parities and limits on the spins of Si^{28} states. These results are, for the ground state, $J^\pi = 0^+, 1^+, 4^+$, or 5^+; 1.78-Mev state, $J^\pi = 2^+$ or 3^+; 4.62-Mev state, $J^\pi = 1^-$ to 4^-; 6.24-Mev state, $J^\pi = 2^+$ or 3^+; 6.88-Mev state, $J^\pi = (1^-$ to $4^-)$; 7.90-Mev state, $J^\pi = 2^+$ or 3^+; 8.57-Mev state, $J^\pi = 2^+$ or 3^+; 9.39-Mev state, $J^\pi = 2^+$ or 3^+. It is pointed out that the odd parity of the 4.62-Mev state of Si^{28} is consistent with the possible shell-model states of a spheroidal nucleus. (auth)

1720

PHOTONEUTRONS FROM LEAD. M. Elaine Toms (U. S. Naval Research Lab., Washington, and William E. Stephens (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 108, 77-81(1957) Oct. 1.

The photoneutrons ejected from a small Pb target by 23-Mev bremsstrahlung x rays from a betatron have been observed by means of recoil protons in nuclear emulsions. The angular distribution of the more energetic photoneutrons was nearly isotopic. The yield, in units of 10^7 neutrons per mole-roentgen, was 1.4 ± 0.2. The observed energy distribution had its maximum near 1.75 Mev. A yield curve for photoneutrons was obtained using neutron counters in paraffin. A cross-section curve was derived from the yield curve with a normalization based on the nuclear-emulsion data. The calculated energy distribution which gave a satisfactory fit to the observed photoneutrons consisted of 90% "evaporation" from a compound nucleus and 10% emission by the "resonance" direct effect. In calculating the contribution of "evaporated" neutrons a nuclear "temperature" for the residual nucleus of 1.35 Mev was used, and the factors for transmission of $l = 0$ neutrons through a centrifugal barrier were applied. (auth)

1721

ANGULAR DISTRIBUTION OF THE $D(d,n)He^3$ REACTION BELOW 1 Mev. J. C. Fuller, W. E. Dance, and D. C. Ralph (Louisiana State Univ., Baton Rouge). Phys. Rev. 108, 91-3(1957) Oct. 1.

Angular distributions of the $D(d,n)He^3$ reaction have been measured at 9 deuteron energies ranging from 0.1 Mev. to 0.9 Mev. Neutrons were detected by two plastic scintillators mounted on photomultiplier tubes, one of which could be rotated to make angles of 0° to 165° with the beam direction. The other scintillator, placed on the rotational axis, was used as a reference counter. Data were fitted to the expression $d\sigma(\theta') = d\sigma(90°)(1 + A\cos^2\theta' + B\cos^4\theta')$ in the center-of-mass system by the method of least squares. The asymmetry coefficients are compared with those obtained by other workers. (auth)

1722
VELOCITIES OF FRAGMENT PAIRS FROM U^{233}, U^{235}, AND Pu^{239} FISSION. William E. Stein (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 94-8(1957) Oct. 1.

Velocities of the fragment pairs from thermal-neutron-induced fission of U^{233}, U^{235}, and Pu^{239} have been measured by a time-of-flight method. The primary masses and energies of the fragments have been determined from the conservation of mass number and momentum. These results are compared with previous fission-fragment-mass and -energy measurements. A decrease of the total kinetic energy near the symmetric mode is observed, which is in agreement with previous double-ionization-chamber measurements. The intrinsic energy spread for mass-97 fragments was found to be 8.1 ± 1.6% with a 95% confidence interval. (auth)

1723
CROSS SECTION FOR THE (n,2n) REACTION IN Be^9. George J. Fischer (State Univ. of Iowa, Iowa City). Phys. Rev. 108, 99-103(1957) Oct. 1.

The cross section for the (n,2n) reaction in Be^9 has been measured for neutron energies between 2.6 and 3.25 Mev. It was found that the reaction sets in sharply at approximately 2.7 Mev, from which energy the cross section rises rapidly to 0.70 barn at 3.25 Mev. This experimental result strongly suggests that the reaction proceeds primarily by means of an inelastic interaction which leaves the excited Be^9 nucleus in its 2.43-Mev level before emission of the second neutron upon breakup. There is no peak in the (n,2n) cross section corresponding to the broad peak at 2.73 Mev in the total neutron cross section. (auth)

1724
NEW 20-HOUR ELECTRON-CAPTURING RHENIUM ISOTOPE, Re^{181}. Charles J. Gallagher, Jr., Michael Sweeney, and John O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 108, 108-10(1957) Oct. 1.

A new 20 ± 2 hour electron-capturing rhenium isotope has been investigated. A mass assignment to Re^{181} is made from the energy threshold for its production by alpha-particle bombardment of Ta^{181} and by the chemical separation and identification of its radioactive daughter, W^{181}. A very prominent 365.5-kev transition is observed in the gamma-ray and electron spectra. It is deduced from the 365.5-kev gamma to K x-ray intensity ratio that more than 80% of the electron capture populates the level at 365.5 ± 0.2 kev above the ground state. This level apparently decays directly to ground by a delayed M2 transition, and is believed to be the same 14-microsecond isomer observed by others from a (γ,n) reaction on W^{182}. A possible interpretation of the 365.5-kev transition in terms of the odd-neutron states of a spheroidal well is given. (auth)

1725
NUCLEAR FISSION. J. A. Wheeler (Univ. of Leiden, Holland). Soviet J. Atomic Energy No. 5, 743-51(1956).

Nuclear fission is reviewed. The value of a channel analysis is noted in determining fission cross sections, fluctuations in fission widths and fission asymmetry. The importance of barrier height in any fission mode is emphasized. The difficulty of obtaining the mass distribution of fission fragments by a statistical theory is noted; this situation arises because the result is a strong function of the deformation factors of the fragments. (auth)

Particle Accelerators

1726 CERN-57-39
European Organization for Nuclear Research, Geneva.
MOTION OF CHARGED PARTICLES IN ROTATING FIELDS. F. Krienen. Sept. 1, 1957. 13p.

1727 MURA-300
Midwestern Universities Research Assn., Madison, Wis.
STABILITY LIMITS FOR THE NON-LINEAR RESONANCES IN A GENERAL SPIRAL SECTOR ACCELERATOR. G. Parzen. June 9, 1957. 6p. Contract AT(11-1)-384. $1.80(ph OTS); $1.80(mf OTS).

The results which have been found for the stability limits due to the non-linear resonances, $\nu_x = \frac{1}{3}$ N $\nu_x + 2\nu_y = N$ and $\nu_x - 2\nu_y = 0$ of a general spiral sector machine are presented. No derivations are given and the results are given in a rough form with an estimate of the errors involved. (auth)

1728 MURA-365
Midwestern Universities Research Assn., Madison, Wis.
THEORY OF THE $2\nu_y - \nu_x = 0$ NON-LINEAR RESONANCE IN ALTERNATING GRADIENT ACCELERATORS. G. Parzen. Sept. 26, 1957. 19p. Contract AT(11-1)-1384. $3.30(ph OTS); $2.40(mf OTS).

The method previously presented for treating the non-linear resonances in alternating gradient accelerators is applied to the $2\nu_y - \nu_x = 0$ coupled resonance. The results of the theory for the threshold amplitudes for the appearance of growth are compared with those of numerical calculations. (auth)

1729 UCRL-3701(Rev.)
California. Univ., Berkeley. Radiation Lab.
THE FAULT DIVERTER—A PROTECTIVE DEVICE FOR HIGH-POWER ELECTRON TUBES. Bob H. Smith. Aug. 1957. 21p. Contract W-7405-eng-48. $0.75(OTS).

Fault diverters, or crowbars, have proven to be very effective protection against transient-induced power arcs within accelerator oscillator tubes. This device short circuits the oscillator-plate power supply in the event of an over-current, thus removing the power flow from the fault within a few microseconds. Ignitrons, thyratrons, and triggered spark gaps are used for this purpose. The power supply is protected from the short circuit either by a current-limiting device or a high-speed contactor which removes the system from the power lines within a few milliseconds. The fault diverters, and associated circuitry, used on several of the accelerators in Berkeley and Livermore are described. (auth)

1730 UCRL-3913
California. Univ., Berkeley. Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. XII. [Period covered] November, December 1956, January 1957. Walter D. Hartsough. Aug. 1, 1957. 18p. Contract W-7405-eng-48. $0.50(OTS).

Studies of π-meson and K-meson interactions were continued with counters, emulsions, and the 10-inch liquid hydrogen bubble chamber. Six emulsion exposures were made for external groups to a π-meson beam, three to K-meson beams, two to a neutral-particle beam, and three to the internal proton beam. An H-D reaction, catalyzed by μ mesons, was observed in the 10-inch liquid hydrogen bubble chamber. Absorption cross-section measurements for antiprotons were continued, using counters. Nineteen target bombardments were made for the chemistry group. A technique of producing two or more secondary-particle beam pulses per acceleration cycle, using different targets, has been successfully tried and used. (For preceding period see UCRL-3614.) (auth)

1731
THE VACUUM EQUIPMENT FOR THE CERN SYNCHRO-CYCLOTRON. Wolfgang Schubert. die atom wirtschaft 2, 332-4(1957) Oct. (In German)

1732
EQUATIONS FOR THE ION MOTION IN A FIXED FREQUENCY CYCLOTRON. Maksimilijan Konrad (Inst. »Ruđer Bošković«, Zagreb, Yugoslavia). Glasnik Mat. Fiz. i Astron. 11, No. 3-4, 253-61(1956).

1733
THE PROJECT FOR A 28 Mev ELECTRON ACCELERATOR FOR THE CENTER FOR NUCLEAR STUDIES AT SACLAY. E. Picard, Leboutet, and Vastel. L'Onde Electrique 37, No. 358, (1957) Jan. (In French)

1734
INFORMATION ON A 2.5 Mev MICROTRON. A. Carrelli and F. Porreca. Nuovo cimento (10) 6, 729-34(1957) Sept.

An electron microtron of the a = 3, b = 1 model has been built and its essential parts are described. Ten orbits have been obtained and the final energy of the particles is 2.5 Mev. The machine is at present without an extractor and therefore only γ rays are available. The average intensity on the last orbits is some 10^{-7} A. (auth)

1735
ACCELERATORS OF LIGHT PARTICLES IN SCIENCE AND IN THE NATIONAL ECONOMY. P. K. Oshchepkov. Vestnik Akad. of Sciences S.S.S.R. 27, 25-30(1957) Sept. (In Russian)

Descriptions are given of the design, performance, and applications of a 25-Mev betatron. (R.V.J.)

Radiation Absorption and Scattering

1736 CEA-655
France. Commissariat à l'Énergie Atomique, Paris.
POLARISATION DU RAYONNEMENT DE FREINAGE. (Polarization of Bremsstrahlung). J. Miller. 1957. 20p.

The numerical results for the polarization of bremsstrahlung are presented. The multiple scattering of electrons in the target is taken into account. The angular and photon energy dependences are seen on the curves for an incident 25 Mev electron energy. (auth)

1737 HASL-2
New York Operations Office. Health and Safety Lab., AEC.
A SEMI-EMPIRICAL METHOD OF CALCULATING THE ENERGY-ABSORPTION BUILD-UP FACTOR WITH AN APPLICATION TO A UNIFORMLY CONTAMINATED SPACE HAVING SPHERICAL BOUNDARIES. Keran O'Brien, Wayne M. Lowder, and Leonard R. Solon. Oct. 14, 1957. 15p. $0.50(OTS).

A form for the point-source gamma-ray energy absorption build-up function valid for a material in the energy range where it is essentially a Compton scatterer is suggested as a modification of the asymptotic forms derived by U. Fano. Its parameters are evaluated by means of an energy equilibrium condition and a fit to experimental data. The results are compared with those obtained by other methods, and an application to the problem of uniformly and continuously distributed point-sources is discussed. (auth)

1738 WADC-TR-57-446
Texas Nuclear Corp., Austin, Tex.
THE ELASTIC SCATTERING OF FAST NEUTRONS FROM OXYGEN AND NITROGEN. [Period covered] July 1, 1956 to July 31, 1957. Norman A. Bostrom, Ira L. Morgan, J. Thomas Prud'homme, and Abdul R. Sattar. Sept. 1957. 87p. Project No. 6(1-9964)-1252. Contract AF33(616)-3790. (AD-131049).

The differential elastic scattering of fast neutrons from O_2 and N_2 was measured as a function of neutron energy and scattering angle in the energy range from 3.0 to 16 Mev using a ring-type geometry. Curves were obtained "on and off" resonances in the total cross section, and very marked differences in the shape of the angular distributions were observed. In general, the angular distributions become more peaked in the forward direction as the neutron energy is increased. Comparisons between the experimental results and theoretical predictions have been made at several energies. (auth)

1739 AEC-tr-3026
REVERSE DISPERSION RELATIONS. V. Blank and D. Shirkov. Translated from a publication of the Joint Inst. for Nuclear Research, U.S.S.R. 1957. 8p.

Reverse dispersion relations for pion-nucleon scattering are considered for the case in the high region when the real part of the scattering amplitude is considerably less than the imaginary one. These relations take the form $A(E) = -(1/\pi)\, P \int_{-\infty}^{\infty} (D(E')/E' - E)\, dE'$. A solution to the problem of the determination of the function D(E) in the positive energy unobserved region is proposed. (M.H.R.)

1740 AEC-tr-3064(Pt. I)
THEORY OF SCATTERING OF X-RAYS IN GASES, LIQUIDS, AMORPHOUS SOLID BODIES AND POLYCRYSTALLINE MATERIALS. [PART] I. V. N. Filipovich. Translated from Zhur. Tekh. Fiz. 25, 1604-21(1955). 24p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 10, as abstract No. 429.

1741 AEC-tr-3064(Pt. II)
THEORY OF SCATTERING OF X-RAYS IN GASES, LIQUIDS, AMORPHOUS SOLID BODIES AND POLYCRYSTALLINE MATERIALS. [PART] II. V. N. Filipovich. Translated from Zhur. Tekh. Fiz. 25, 1622-38(1955). 23p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 10, as abstract No. 430.

1742
POSSIBLE EXPERIMENTS IN STUDYING THE PROCESSES OF INELASTIC SCATTERING OF NUCLEONS. I. L. M. Soroko. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. May 1957. (In Russian)

Nucleon inelastic collisions $N + N \rightarrow \pi + N + N'$ at ~650 Mev were studied, and the angular correlation of the mesons and nucleons based on the azimuthal asymmetry in the emissions of these particles was determined. Similar effects were investigated in the polarized nucleon beams. Calculations were developed for the inelastic transitions supposedly composing the total cross section of $N + N \rightarrow \pi + N + N'$ processes at 650 Mev. (tr-auth)

1743
POLARIZATION IN p-p SCATTERING AT 635 MEV. M. Meshcheryakov, S. Narushev, and G. Stoletov. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. 1957. (In Russian)

The angular distribution of polarized protons scattered in hydrogen at 635 Mev did not differ from the polarization in p-p scattering at 300 to 400 Mev. Analysis of p-p scattering at 657 Mev, studied by an optical model, showed a negligible Coulomb and nuclear interference which rather increased the differential cross section in p-p scattering in the range $11 \leq \phi \leq 16°$. The angular distributions of the assymetric portion in p-p scattering are similar at 635 Mev. (To be translated. The translation will be announced in NSA, when available.) (R.V.J.)

1744
EJECTION OF DEUTERONS FROM Li, Be, C, AND O BY

675 MEV PROTONS. L. Azhgirei, I. Vzorov, et al. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. 1957. (In Russian)

Investigations with a magnet at 7.6° angle in relation to the proton beam revealed deuteron group emissions with energies near 600 Mev. The elastic (p-d) scattering is the source of fast deuterons for deuterium; for other cases the deuteron emission proceeds with the reaction $p + (Z,A) \rightarrow d + p + (Z-1, A-2)$ which represents the proton scattering into quasi-deuteron groups inside the nucleus. With an order of accuracy ~20% the differential cross section of the reaction is 2.9×10^{-27}, 2.2×10^{-27}, 3.7×10^{-27}, and 4.6×10^{-27} cm²/sterad for Li, Be, C, and O, respectively. The mean energies for the quasi-deuteron motions in these nuclei were estimated to be approximately 8, 11, 14, and 14 Mev. No evidence of strong-pulse spectra was observed in the knock-on nuclei of tritium. Experiments indicated the importance of the triple interaction followed by strong pulse transmissions to deuterons during the passage of nucleons through the light nuclei. The results are in good agreement with the concepts of the nuclear strong-pulse model. (To be translated. The translation will be announced in NSA, when available.) (tr-auth)

1745

MEASUREMENT OF THE ELASTIC SCATTERING OF 1.12 Mev GAMMA RAYS IN LEAD. Eiichi Hara, Jean Banaigs, and Eugene Alexandre. Compt. rend. 245, 963-5(1957) Sept. 9. (In French)

These results agree practically with the semi-empirical calculations of the Rayleigh and Thomson effects. The disagreement between the values for 1.12 Mev of Zn^{65} and those for 1.17 Mev of Co^{60} can be attributed to the inelastic scattering of 1.33 Mev γ rays of Co^{60} due to electrons bound to the nucleus. (tr-auth)

1746

n-p AND p-p SCATTERING FROM CASE-PAIS MODEL IN THE ENERGY-RANGE 91 Mev TO 437 Mev. S. Mukherjee and M. K. Pal (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 31, 415-30(1957) Aug.

A two-body potential consisting of even-parity central and tensor interactions with Yukawa radial dependence, and a Case-Pais type spin-orbit interaction with adjustable exchange dependence have been used to calculate n-p and p-p cross sections in the Born approximation over a wide range of energies and angles. A set of values of parameters in the potential has been obtained corresponding to the best fit with experimental curves. It has been found that though these best fit parameters reproduce n-p cross section satisfactorily from 91 to 400 Mev, they can give the observed isotropy in case of p-p scattering in the range 90 to 35° c.m. angles only up to 345 Mev, beyond which too much forward scattering is predicted. A deduction of the Born approximation scattering formula using Racah's tensor operator formalism and Wigner's D-matrix has been appended. (auth)

1747

THEORY OF HIGH-ENERGY POTENTIAL SCATTERING. D. S. Saxon and L. I. Schiff. Nuovo cimento (10) 6, 614-27 (1957) Sept.

A new formulation for high-energy potential scattering presented in a recent paper, is extended to provide explicit formulas for the scattering theory of the three-dimensional non-separable Schrödinger equation. An integral equation is derived, for which a single iteration gives the scattering when the potential energy is not too large and is slowly varying compared to a wavelength. The result agrees with those obtained earlier for small and for large scattering angles, but applies as well to intermediate angles and improves the earlier accuracy. Further iterations can provide greater accuracy as well as an error estimate for the first approximation. (auth)

1748

ON THE THEORY OF SCATTERING MEASUREMENTS IN NUCLEAR EMULSION. I. THE DISTRIBUTION FUNCTIONS OF THE COORDINATE DIFFERENCES. N. Solntseff (Univ. of Sydney, N.S.W.). Nuclear Phys. 4, 337-62(1957) Sept.

Molière's theory of multiple scattering measurements in nuclear emulsion is here treated in a mathematically simpler way. The distribution functions of the second, third, and fourth differences of coordinates arising from true scattering and noise are derived for the constant-cell method. In the derivation, the parameters B_r are not assumed to be all equal as was assumed by Moliere. As a consequence the scattering constant agrees better with experimental results than the scattering constant calculated by Gottstein et al. It is shown that the relation between the mean noise ϵ_r for the r^{th} differences and the error σ of a coordinate measurement is $\epsilon_2 = 1.96\sigma_N$, $\epsilon_3 = 3.56\sigma_N$ and $\epsilon_4 = 6.68\sigma_N$. Therefore, to obtain a noise level of 0.15 μ for second differences the error σ_N should be less than 0.075 μ. In this case $\epsilon_3 = 0.28$ μ and $\epsilon_4 = 0.50$ μ. The effect of the finite size of the nucleus on the distribution functions of the coordinate differences is evaluated in an approximate way. (auth)

1749

ELASTIC SCATTERING OF ANTIPROTONS BY NUCLEI. I. E. McCarthy (Cavendish Lab., Cambridge). Nuclear Phys. 4, 463-8(1957) Sept.

The large annihilation cross section for antiprotons may be due either to a very strong attraction or to a very small mean free path in nuclear matter and a large nuclear rim of low density. In either case the nucleus must be considered black to antiprotons and the behavior of the beam in the nuclear boundary is important. It is shown that the anomalously small diffraction cross section observed in early experiments cannot be explained by a boundary effect if the real potential is not very large. Emulsion experiments have shown that the differential cross section near 2° is less than that predicted by Rutherford scattering. A similar discrepancy arises from assuming that the nucleus is a charged totally absorbing sphere. (auth)

1750

STRANGE-PARTICLE EFFECTS IN S-WAVE PION-NUCLEON SCATTERING. J. S. Langer (Univ. of Birmingham). Nuovo cimento (10) 6, 674-81(1957) Sept.

An attempt is made to explain the isotopic-spin splitting of the S-wave phase shifts in pion-nucleon scattering in terms of virtual strange-particle effects. A very simple calculation is found to agree quite well with experiment. (auth)

1751

CHARGE DEPENDENT CORRECTIONS TO DISPERSION RELATIONS (II). A. Agodi and M. Cini. Nuovo cimento (10) 6, 686-92(1957) Sept.

The effect of the electromagnetic interactions on the dispersion relations for pion proton scattering is investigated. The correction, which can be interpreted as a difference between the coupling constants for positive and negative mesons, attains a maximum value of the order of 5% in the energy range between 50 and 150 Mev, and is therefore by far too small to account for recent experimental indications. (auth)

1752

APPROXIMATE METHODS IN S WAVE PION NUCLEON SCATTERING. B. H. Bransden and R. G. Moorhouse (The Univ., Glasgow). Nuovo cimento (10) 6, 693-700(1957) Sept.

The reliability of the Tamm-Dancoff and Cini-Fubini methods for S-wave pion scattering is examined, by applying these approximations to an example for which the exact solution is known. It is shown that under certain conditions the Tamm-Dancoff method in its lowest orders is quite accurate, the Cini-Fubini method being unreliable. (auth)

1753

INELASTIC SCATTERING OF PROTONS FROM Cu^{65}, Ni^{58}, Ni^{60}, AND Ni^{62}. R. R. Spencer, G. C. Phillips, and T. E. Young (Rice Inst., Houston, Texas). Phys. Rev. 108, 69-71(1957) Oct. 1.

The Rice Institute 180° magnetic spectrometer was used in measuring the energies of inelastically scattered protons from targets of natural Ni and from targets enriched in the isotopes Ni^{58}, Ni^{60}, Ni^{62}, and Cu^{65}. Energy levels below 3.09-Mev excitation in Ni^{58}, Ni^{60}, and Ni^{62} and below 1.64-Mev excitation in Cu^{65} were determined. (auth)

1754

ENERGY AND ANGULAR DISTRIBUTIONS OF NEUTRONS FROM THE INTERACTION OF 14.1-Mev NEUTRONS WITH ZIRCONIUM. Se Hee Ahn and J. H. Roberts (Northwestern Univ., Evanston, Ill.). Phys. Rev. 108, 110-13(1957) Oct. 1.

The distributions in energy and angle of the neutrons emitted from the interaction of 14.1-Mev neutrons with zirconium have been obtained by using nuclear emulsion plates as detectors. The energy distribution of the low-energy nonelastic neutrons is Maxwellian. The angular distribution of the low-energy nonelastic neutrons (0.5 to 4.0 Mev) is found to be isotropic; whereas, that of the high-energy nonelastic neutrons (4.0 to 12.0 Mev) is peaked in the forward direction. The significance of these results in terms of the statistical model of the nucleus is discussed. (auth)

1755

ELASTIC SCATTERING OF 3.1-Mev POLARIZED NEUTRONS. B. M. McCormac, M. F. Steuer, C. D. Bond, and F. L. Hereford (Univ. of Virginia, Charlottesville). Phys. Rev. 108, 116-19(1957) Oct. 1.

By using a partially polarized neutron beam from the $D(d,n)He^3$ reaction, the elastic scattering polarization of a number of elements has been observed. For Be and C scatterers, the angular dependence of the polarization can be correlated with parameters characterizing compound-nucleus levels excited by the incident neutrons. For medium and heavy scattering nuclei, the observed polarization is in poor agreement with the few existing optical-model calculations for 3.1-Mev neutrons. With the exception of Pb, all medium and heavy elements studied yielded positive polarization in the 30°–60° range of scattering angles, i.e., they would produce polarization in the direction $k_n \times k_n'$ single scattering events. (auth)

1756

BEHAVIOR OF THE MESON-NUCLEON CROSS SECTION AT HIGH ENERGIES. R. Arnowitt (Syracuse Univ., New York) and G. Feldman (Univ. of Wisconsin, Madison). Phys. Rev. 108, 144-7(1957) Oct. 1.

It is shown that within the contest of a local causal field theory the total π-nucleon cross section $\sigma(\omega)$ has the following behavior at high energies: $\lim_{\omega \to \infty} \omega\sigma(\omega) > 0$. (auth)

1757

ELASTIC SCATTERING OF 32 Mev PROTONS FROM GOLD. S. N. Ghoshal and B. B. Baliga (Inst. of Nuclear Physics, Calcutta). Proc. Phys. Soc. (London) A70, 324-30(1957).

The results of an experiment on the elastic scattering of 32 Mev protons from the Berkeley linear accelerator by gold are reported. The photographic plates which had been employed for detection of the scattered protons have been recently scanned systematically. The differential scattering cross section has been plotted as a function of the scattering angle. These include contributions of the inelastic scattering of protons from several low lying levels in Au^{197}. To estimate this effect, the differential distribution of the ranges of the scattered protons in the photographic emulsion has been determined. From this range distribution curve the upper limit of the differential elastic scattering cross section at various scattering angles has been estimated. The positions of the maxima and minima in the cross section curve agree approximately with those given by the elementary theory of diffraction. The results have been compared with the theoretically calculated cross sections obtained by employing Montroll–Greenberg variational method using the optical type square well potential. (auth)

Radiation Effects

1758 NARF-57-19T(Vol. 4)

Convair, Fort Worth, Tex.

FIRST SEMIANNUAL 125A RADIATION EFFECTS SYMPOSIUM, MAY 22-23, 1957. 187p. (FZK-9-118(Vol. 4)).

Topics discussed include: a description of the Battelle Radiation Effects Information Center; the effects of high-energy, high-intensity radiation on organic fluids; the effects of nuclear radiations on rubber-like materials; the effects of radiation on semi-conductors; the effects of irradiation on the performance of electronic equipment; the design of electronic systems to operate in a nuclear environment; the performance of closed circuit television equipment for remote viewing in high radiation fields; the effects of radiation on the performance of commercial electric motors insulated with Alkanex; the effects of radiation on the stability of operating components of a jet engine control system; and determination of the body radiation dose received while working in a multiple source radiation field typical of that encountered in radioactive systems maintenance. (C.H.)

1759 NP-6461

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ACCESSION LIST NO. 4 [ON RADIATION EFFECTS DATA]. Oct. 15, 1957. 57p. Project No. 2133. Contract AF33(616)-5171.

1760 NYO-3786

Bausch and Lomb Optical Co., Rochester, N. Y.

IRRADIATION DAMAGE TO GLASS. Norbert J. Kreidl and J. Raymond Hensler. Oct. 1957 22p. Contract AT(30-1)-1312. $4.80(ph OTS); $2.70(mf OTS).

Investigation of irradiation of very pure SiO_2 powder, the basic glass making raw material, doped with controlled impurities in very small amounts allowed synthesis of known color centers and discovery of new centers. Thermoluminescence measurements were fruitful in investigation of mechanisms of repair of radiation damage. Interaction of centers responsible for ultraviolet and visible bands was indicated by the partial quenching of luminescence during thermal bleaching of samples showing visible coloration. (auth)

1761

STUDY OF THE RADIATION STABILITY OF REACTOR

MATERIALS. P. Müller. Atomkern Energie 2, 312-15 (1957) Aug.-Sept. (In German)

Discussions are included on the choice of the radiation source, the irradiation procedures, dynamic testing, and post-irradiation testing. (M.H.R.)

Radioactivity

1762

EXPERIMENTAL STUDIES OF α DECAY OF ELEMENTS OF INTERMEDIATE ATOMIC WEIGHT. Yu. A. Shirkov (Vernadskii Inst. of Geochemistry and Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 115, 904-6(1957) Aug. (In Russian)

Examinations were made of the α decay in the isotope atomic weight range N = 82 to 126. The α-active isotopes were formed from the bombardment of Er, Yb, and Hf by 70 to 660 Mev protons. The short lived α-active isotopes were bombarded in a cyclotron for a period of 2 hr, and the long lived ones for 3 months. Only pure, chromatographically separated fractions were used in the experiment. The chromatograms of the β and α activities and tables of the resulting materials are presented. The energies of Tb^{149} and Dy^{152} were measured with a multichannel ionization chamber followed by measurements with scintillation α counter; the energies for Gd^{148}, Dy^{153}, and Hf(?) were determined from the tracks in thin layer (50μ) photoplates. (R.V.J.)

1763

Ho^{160} CONVERSION ELECTRON SPECTRUM. B. S. Dzhelepov, B. K. Preobrazhenskiĭ, et al. (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R. Ser. Fiz. 21, 962-5(1957) July. (In Russian)

Conversion electron spectra of Er and Ho fractions, recovered from Ta after bombardment with 660-Mev protons, were studied with a two-lens spectrometer. (R.V.J.)

1764

Ag^{110} γ RADIATION. B. S. Dzhelepov, N. N. Zhukovskiĭ, and Yu. G. Kondakov. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 973-7(1957) July. (In Russian)

The basic data on Ag^{110} decay scheme are presented in graphical form. The relative intensities of Ag^{110} γ lines were determined. The balance of intensities was examined on separate levels, and multipole transitions were identified. (R.V.J.)

1765

In^{114*} γ SPECTRUM. I. B. Golovanov, B. S. Dzhelepov, et al. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 985-6(1957) July. (In Russian)

Energies and intensities of In^{114*} γ lines are presented, and the quantum numbers of the decay for all γ transitions were determined. The diagram of recoil electron distribution for In^{114*} shows a surplus of recoil electrons between the 190 and 556 kev γ lines. A rough estimation indicates that the surplus obviously is related to the radiation bremsstrahlung produced by strong β particles. (R.V. J.)

1766

ABOUT THE NEW LINES IN RaC SPECTRUM. I. E. Uchevatkin and S. A. Shestopalova (Mendeleev All-Union Research Inst. of Metrology). Izvest. Akad Nauk S.S.S.R. Ser. Fiz. 21, 1002-3(1957) July. (In Russian)

The 2400 and 3400 kev region of the RaC(Bi^{214}) spectrum was investigated to find the reason of excess background coincidences. The 2614 kev γ line for ThC′ and the 2758 kev γ line for Na^{24} have been measured. Studies of the RaC spectrum beyond the 2450 kev line revealed a systematic increase in the background effect up to the 3200 kev line; the background comprised ~10% of the effect in this spectrum area. The estimated intensity of the observed "excess" was 10 times weaker than the 2450 kev line, which is $\sim 2 \times 10^{-3}$ quantum at decay. (R.V.J.)

1767

THE FIELD OF RADIATION OF A RECTANGULAR SOURCE. E. E. Kovalev, V. I. Popov, and L. N. Smirennyi. J. Nuclear Energy 5, 424-5(1957).

1768

A POWERFUL γ-SOURCE WITH AUTOMATIC CONTROL. F. G. Firsov. J. Nuclear Energy 5, 425-6(1957).

1769

A DETERMINATION OF THE GAMMA-RAY EMISSION OF RADIUM. Frank H. Attix and Victor H. Ritz. J. Research Natl. Bur. Standards 59, 293-305(1957) Nov.

Measurements of the γ-ray emission of radium (roentgens per milligram-hour at 1 centimeter) have been made by means of a graphite cavity ionization chamber. An auxiliary experimental examination of the stopping-power correction for the non-air-equivalence of the cavity wall is also described. The resulting average value for the γ-ray emission of radium (enclosed in an 0.5-millimeter platinum capsule) is 8.26 ± 0.05 roentgens per milligram-hour at 1 centimeter, which is based upon the conclusion that the stopping-power data of Bakker and Segre are consistent with the results of the auxiliary experiment. (auth)

1770

URANIUM, HELIUM AND THE AGES OF METEORITES. George W. Reed (Argonne National Lab., Lemont, Ill.), and Anthony Turkevich (Univ. of Chicago, Ill.). Nature 180, 594-6(1957) Sept. 21.

1771

AVERAGE ENERGY OF ALLOWED BETA-PARTICLE SPECTRA. R. Loevinger (Mount Sinai Hospital, New York). Phys. in Med. and Biol. 1, 330-9(1957) Apr.

The average β-particle energy per disintegration ($\bar{E}_\beta$) has been calculated relative to the maximum β-particle energy (E_0). The ratio $\bar{E}_\beta/E_0$ is given in graphical form for all values of atomic number and β-particle energy likely to be of medical or biological interest, for both negatrons and positrons. A table of the average β-particle energy is given for some of the radioisotopes of current medical and biological interest. (auth)

1772

CIRCULAR POLARIZATION DETECTION OF GAMMA RAYS. David B. Beard (Lockheed Aircraft Corp., Palo Alto, Calif.) and M. E. Rose (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 164-5(1957) Oct. 1.

Because of recent interest in circular polarization of gamma rays due to its relevance to the parity conservation question, the authors suggest an experimental method for circular polarization detection. The method suggested consists in Compton scattering a circularly polarized gamma ray from electrons whose spin axes are aligned predominantly in the direction of the photon propagation vector. (A.C.)

1773

STUDIES OF RADIOACTIVITY IN THE ATMOSPHERE. (Work of the Lithuanian Scientists). B. I. Styro. Vestnik Akad. Nauk S.S.S.R. 27, 49-54(1957) Aug. (In Russian)

A survey of data. (R.V.J.)

1774

NEW PREPARATION METHODS OF α-, β-, AND γ-SOURCES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/11. M. S. Petrova, D. M.

Zeav, Shwebelbleet, I. I. Balaklayets, W. P. Sytin, and W. N. Tshessalin. London, Pergamon Press, Ltd., 1957. 9p.

The advisability of the practically universal methods of preparing α-, β-, and γ-sources on the basis of oxide films and on the basis of inorganic enamels is shown, such sources allowing for a wide range both in intensity and in form. (auth)

1775

HIGH-INTENSITY Co^{60} GAMMA-RAY SOURCE FOR STUDIES IN RADIATION CHEMISTRY. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/20. A. Kh. Brager, V. A. Belynsky, V. L. Karpov, S. D. Prokudin, and V. B. Osipov. London, Pergamon Press, Ltd., 1957. 13p.

A Co^{60} gamma ray source has been developed and built, which is equal to basic present-day standards of radiation chemistry research. 'K-20 000' source is a hollow cylinder (height 250 mm, outside diameter 140 mm, inside diameter 65 mm) containing 56 Co^{60} preparations with a total activity of 21 000 g. equiv. of radium. The source was assembled by means of special devices employing no water shielding. Irradiation is effected in the working chamber (~ $1m^3$) into which the source is introduced with the help of remote control mechanism. The chamber is surrounded with concrete walls 1.5 to 2m. Access into the chamber is gained through a labyrinth. Mechanisms are provided for safe elimination of possible remote control troubles. During intervals between experiments the source is kept in a mobile lead container. (auth)

Rare Earths and Rare-earth Compounds

1776 AECU-3571

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RMF MEASUREMENTS ON MTR-IRRADIATED EUROPIUM OXIDE. J. W. Henscheid and E. Fast. Jan. 18, 1957. 13p. Contract AT(10-1)-205. (PTR-156). $3.30(ph OTS); $2.40(mf OTS).

Aluminum capsules with Al inserts and He atmospheres and containing 4 strips of Eu_2O_3–stainless steel were measured in the Reactivity Measurement Facility at MTR, both before and after irradiation. (T.R.H.)

1777 AFOSR-TN-57-561

Munich. Physikalishes Institut der Technischen Hochschule.

MAGNETIC PROPERTIES OF RARE EARTH METALS AT VERY LOW TEMPERATURES. [Period Covered] May 1, 1956–July 31, 1957. Hugo Leipfinger. July 31, 1957. 41p. Contract AF-61(514)-941. (AD-136546).

The magnetic susceptibilities of the rare earth metals Ce, Pr, Nd, Sm, Dy, and Yb were measured from 293°K down to 1.5°K. The general results indicate that, with the exception of Yb and possibly Eu (not yet measured) the ions, which constitute the lattice of the metal, are the same as in the salts or oxides. Yb is built up by divalent ions. The small magnetism allows not more than 2% Yb^{3+} ions, and even this magnetism can be caused by impurities. In the salts the deviations from the Curie law are caused by crystal field splitting of the electronic terms; in metals this splitting is, if it exists at all, weak, while exchange coupling brings in most cases either antiferromagnetism or ferromagnetism. Together with the measurements of other metals not yet finished, one can guess the rule that at very low temperatures the metals of the first half, Ce–Eu, are antiferromagnetic, the metals of the second half ferromagnetic. No coupling effects were observed in Pr and Yb, the latter being up by divalent ions. (auth)

1778

CONVERSION ELECTRON SPECTRA OF NEUTRON DEFICIENT LUTETIUM ISOTOPES. Yu. G. Bobrov, K. Ya. Gromov, et al. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 940-53(1957) July. (In Russian)

The conversion electron spectrum was studied using Lu prepared from Ta targets after various irradiations. The relative intensities of Lu conversion lines with half life ~ 170 days and the spectra of conversion electrons of Lu isotopes with $T_{1/2}$ = 150 to 200 days are shown graphically. Comparisons are made of the experimental K/L ratios with theoretical calculations. The Lu^{174} and Lu^{173} decay scheme and a table of relative γ-ray intensities and conversion electrons are included. The conversion electrons of Lu isotopes with a half life of about a week were observed in the Lu spectra after long and short irradiations, and tables of energy, relative intensities, and comparisons made of the experimental and theoretical K/L ratios are shown. Also, the juxtaposition of the energy and relative intensities of the conversion lines observed in Lu with energies and intensities of Yb^{169} lines were analyzed, and tables of conversion lines for Lu isotopes with a 2 day period are presented. Comparisons are made of experimental K/L ratios with theoretical calculations for transitions at 84.3 kev. (R.V.J.)

1779

ON THE NEUTRON DEFICIENT RARE EARTH ISOTOPES PRODUCED BY Ta SPALLATION DURING BOMBARDMENT BY 660 Mev PROTONS. G. M. Gorodinskin, A. N. Murin, et al. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1004-11(1957) July. (In Russian)

The products of deep spallation of Ta targets bombarded in a synchrocyclotron have been studied. The corrected decay schemes for Lu^{173} and Tn^{167} are presented. (R.V.J.)

1780

THE CRYSTAL STRUCTURE OF YTTRIUM NITRIDE. Charles P. Kempter, N. H. Krikorian, and Joseph C. McGuire (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 1237-8(1957).

Yttrium nitride was prepared by converting Y metal to YH_2 and then to YN. The polycrystalline YN was examined by x-ray diffraction, using both photographic and diffractometric methods. Yttrium nitride has space group O_h^5-Fm3m (NaCl structure-type) and 4 (YN) per unit cell. The lattice constant is 4.877 ± 0.006 A at 23°, and the calculated density is 5.89 ± 0.02 g/cm^3 at 23°; the pycnometric density was found to be 5.60 ± 0.05 g/cm^3 at 20°. The melting point of YN is ≥2670° in the presence of one atmosphere of N. (auth)

Shielding

1781 WKNL-89(Vols. 1 and 2)

Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.

SHIELDING CHARACTERISTICS OF AIR, SOIL, WATER, WOOD AND OTHER COMMON MATERIALS. VOLUME 1. AIR SCATTERING OF GAMMA RAYS AND NEUTRONS. VOLUME 2. ATTENUATION OF GAMMA RAYS AND NEUTRONS. David Spielberg. Feb. 28, 1957 (Vol. 1). 151p. and Mar. 25, 1957 (Vol. 2). 189p. Contract DA-44-009-eng-2874(7).

These two volumes were issued separately, but are cataloged as a unit.

Basic data and the results of calculations relevant to the problem of reactor shielding with materials readily avail-

able at remote reactor sites are presented. The results are presented in graphical form so that shielding needs may be readily evaluated at the reactor site. In essence, this can be called a field-expedient shielding manual. Theory, approximations, and error limits are also given so that the more technical reader is made cognizant of the range of validity of the results. Data are presented on the air scattering of gamma rays and neutrons. (auth)

1782

CONCRETE IN RADIATION SHIELDING TECHNOLOGY. Thomas Jaeger. Atomkern Energie 2, 338-44(1957) Aug.-Sept. (In German)

1783

SCALING NEUTRON TRACKS IN MONTE CARLO SHIELDING CALCULATIONS. K. W. Morton (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Nuclear Energy 5, 320-4(1957).

A simple technique is given to enable neutron tracks generated in a Monte Carlo study of a given slab of material to be used for slabs of any other thickness. It is applied to the interpretation of some thick sample scattering data. (auth)

1784

REMOTE HANDLING. 4. SHIELDING SYSTEMS. R. A. G. Welsher (A.E.R.E., Harwell). Nuclear Eng. 2, 427-30 (1957) Oct.

Various types of materials for shielding against high-energy radiation are considered. (W.L.H.)

1785

THE DESIGN AND CONSTRUCTION OF LARGE GAMMA IRRADIATION FACILITIES. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/19. G. S. Murray, R. Roberts, and D. Dove. London, Pergamon Press, Ltd., 1957. 11p.

The design of radiation shielding suitable for sources of many thousands of curies of gamma activity is discussed. The main object in the design has been to achieve maximum flexibility in operation. It has been found advantageous to be able to carry out irradiations over a wide range of physical conditions, such as temperature and pressure, and also to impose the minimum restriction on the size of vessel being irradiated. The requirements have been met in an entirely new design of irradiation unit. The advantages of a large concrete shield compared with the usual lead shield are discussed. A particular feature of the design is the achievement of a variable source geometry, so that a source of any shape can be built up within a large irradiation chamber. Attention is drawn to the need for simplicity in operation while achieving maximum protection for personnel using the source. Details are given of interlock mechanisms, and also the dose rates obtained at various positions in completed shield. Some figures for the cost of construction of large radiation sources are also included. (auth)

Spectroscopy

Refer also to abstract 1575.

1786

AN IRON-FREE MAGNETIC BETA-RAY SPECTROMETER OF HIGH LUMINOSITY, RESOLVING POWER, AND PRECISION FOR THE STUDY OF DECAY SCHEMES OF THE HEAVY ISOTOPES. Jesse W. M. DuMond (California Inst. of Tech., Pasadena). Annals of Physics 2, 283-371(1957) Oct.

A complete detailed description of the purposes, theory, design, and techniques of operation of this high-precision, high-resolution, automatically recording instrument is presented. Some representative results are shown and figures of merit are obtained and displayed on Persico-Geoffrion charts for comparison with other instruments. A few examples of its performance are shown and a complete list of references to all nuclear decay schemes so far studied with the instrument is given. The present design represents the cumulative result of numerous modifications and improvements over five years of practical working experience since it was first put into operation. (auth)

1787

MULTIPLE ECHOES IN SOLIDS. Ionel Solomon. Compt. rend. 245, 1011-14(1957) Sept. 16. (In French)

The application of the method of spin echoes to the magnetic resonance of a nucleus giving the line is enlarged by quadrupolar interaction with electrical gradients due to crystal imperfections, permitting the demonstration of a new type of echo. It is in this way that the iodine nucleus of KI crystals gives, conforming to the theory, five echoes for a sequence of two high frequency impulses. (tr-auth)

1788

PORTABLE SPECTROMETER FOR IDENTIFYING METALS. Louis E. Owen and Robert F. O'Connell (Goodyear Atomic Corp., Portsmouth, Ohio). Metal Progr. 72, No. 3, 94(1957) Sept.

1789

ON THE POSSIBILITY OF APPLYING TROCHOIDAL ORBITS IN BETA-SPECTROSCOPY. K. G. Malmfors (Nobel Inst. of Physics, Stockholm). Nuclear Instr. 1, 251-2(1957) Sept.

1790

ROTATIONAL SPECTRUM OF Tm^{171}. E. N. Hatch and F. Boehm (California Inst. of Tech. Pasadena). Phys. Rev. 108, 113-15(1957) Oct. 1.

The gamma rays emitted from Tm^{171} following the Er^{171} beta decay have been measured with the two-meter curved-crystal spectrometer and a semicircular beta-ray spectrometer, enabling a comparison of the nuclear levels and rotational parameters for the Tm^{171} ground-state band with the corresponding levels and parameters of Tm^{169}. The measured gamma rays have the following energies in kev: 5.06 ± 0.05, 12.40 ± 0.05, 111.63 ± 0.02, 116.69 ± 0.03, 124.03 ± 0.03, 210.62 ± 0.15, 284.9 ± 0.7, 295.97 ± 0.15, 308.37 ± 0.15. In comparing the rotational parameters, a slight increase in the deformation of Tm^{171} over that of Tm^{169} is noted. The relatively large change in the decoupling parameter ($a = -0.8563$) for Tm^{171} compared with that of Tm^{169} cannot be accounted for entirely by the small change in nuclear deformation. (auth)

1791

THE USE OF RADIOACTIVE ISOTOPES IN SPECTRAL ANALYSIS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/47. E. E. Weinstein, L. I. Pavlenko, and Y. I. Belyaev. London, Pergamon Press, Ltd., 1957. 23p.

Methods are described for separate investigation of evaporation and atomic excitation processes in sources used in spectral analysis. These methods are based on the application of a radioisotope of the element studied. Conditions of excitation and evaporation of molybdenum from different silicate rocks have been studied. Tracer technique was employed to study the process of impurities extraction from different matrices in air and in vacuo. (auth)

Theoretical Physics

1792

DERIVATION OF THE ENERGY-DISTRIBUTION FORMULAS OF QUANTUM STATISTICS. R. D. Cowan. Am. J. Phys. 25, 463-5(1957) Oct.

The energy-distribution formulas of quantum statistics are derived in a way which treats all three cases (Bose-Einstein, Fermi-Dirac, and corrected Boltzmann) in a similar manner, so that the relationship of each case to the others is clear throughout the derivation. Stirling's formula for the factorial, which is of dubious applicability in the Fermi-Dirac case, is not required. (auth)

1793

APPROXIMATIONS FOR COULOMB WAVE FUNCTIONS. R. H. Barlett, M. H. Rice, and R. H. Good, Jr. (Pennsylvania State Univ., University Park). Annals of Physics 2, 372-83(1957) Oct.

A discussion of WKB-type approximations to the solutions of the radial wave equation for a Schrödinger particle in a Coulomb field is given. Approximations based on Airy integrals, $(L + \frac{1}{2})$-order Bessel functions, and $(2L + 1)$-order Bessel functions are considered. The results indicate that important factors in the choice of the basic function for the approximation are the poles in the effective potential. (auth)

1794

MANY-BODY PROBLEM IN QUANTUM FIELD THEORY. Abraham Klein and Charles Zemach (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 108, 126-38 (1957) Oct. 1.

A formalism for the covariant description of scattering processes involving composite particles is derived from first principles. Its basic ingredients are the Green's functions of quantum field theory combined with a physically sound formulation of the adiabatic hypothesis. Explicit expressions are presented for various examples of nucleon-nucleus and boson-nucleus collisions. It is shown that the impulse approximation can be formulated for such problems. A general method of obtaining electromagnetic moments of nuclei, based on the scattering formalism, is also derived. The normalization condition for covariant amplitudes is discussed and its application to bound-state problems reviewed. In particular, a method of carrying out perturbation theory for the discrete spectrum is suggested. (auth)

1795

APPLICATIONS OF A HIGH-ENERGY COULOMB WAVE FUNCTION. R. E. Prange and R. H. Pratt (Univ. of Chicago, Ill.). Phys. Rev. 108, 139-43 (1957) Oct. 1.

The well-known approximate Coulomb wave function, which is essentially the asymptotic form of the exact wave function, is shown to be valid in the computation of certain high-energy, small-angle processes. In an explicit calculation of the atomic photoelectric effect, the result of Hall is obtained in a somewhat more convenient form. Approximations to this result are discussed and the limiting case $Ze^2/\hbar = 1$ is evaluated. For bremsstrahlung and pair production, it is found that the wave function is not completely adequate, although still useful. The Coulomb scattering cross section may also be computed if sufficient care is exercised. (auth)

1796

p-p TRIPLE SCATTERING PREDICTIONS AT 100-170 Mev. J. L. Gammel and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 163-4(1957) Oct. 1.

Since proton-proton triple scattering experiments in the 100 to 170 Mev range may soon become available, an attempt is made to predict the results of such experiments. Such predictions are made on the basis of the phenomenological nuclear-nuclear interaction proposed by the authors. It is hoped that these predictions will be helpful in planning such experiments. Moreover, comparison of these predictions should provide a test of the theory. (A.C.)

1797

THE STRUCTURE OF NUCLEONS. B. Neganov. Report presented at the All-Union Conference on Physics of High Energy Particles, May 22, 1956. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. Jan. 1957. 23p. (In Russian)

A hypothesis was developed on the nucleon structure and its structural elements. The role of the new particles (hyperons and K mesons) in nuclear interactions and their relation to the nucleonic structure are discussed. (To be translated. The translation will be announced in NSA, when available.) (R.V.J.)

1798

PROBLEMS OF THE THEORY OF DISPERSION INTERRELATIONSHIPS. N. N. Bogoiyubov, B. V. Medvedev, M. K. Polevanov, and D. V. Shirkov. Joint Institute of Nuclear Research. Laboratory of Theoretical Physics. Mar. 1957. 142p. (In Russian)

The field theory was developed based on the dispersion relations. Explicit relations were obtained for separate matrix elements in the dispersion matrix. These relations are not associated with any degree of expansion but are based on the analysis of the analytical properties of matrix elements for the total S matrix as a unit. The basic properties of the S matrix in local field theory, the spectral representation of the pion Green's functions, the spectral representation of the fermion Green's function, the amplitude pion scattering in nucleons, the problems of analytical expansion of amplitude of scattering at $p \neq 0$, and the equations of dispersion for pion scattering in nucleons are discussed. (R.V.J.)

1799

GENERAL COVARIANT FORMULATION OF THE FIELD THEORY AND GENERAL LAWS OF CONSERVATION. Duan I-Shi. Joint Institute of Nuclear Research. Laboratory of Theoretical Physics. 1957. 11p. (In Russian)

Data are given on the general covariant formulation of the theory of elementary particles and on the generalization of the Heter theorem. A generalized law of conservation in the general theory of relativity is discussed, and it is shown that it is possible to develop the law of conservation of energy, pulse, moment of momentum, charge, etc. (R.V.J.)

1800

WHEN DOES A WEAK INTERACTION BECOME STRONG? D. I. Blokhintsev. Joint Institute of Nuclear Research. 1957. (In Russian)

Weak interactions of electrons with μ mesons and neutrinos were studied, based on the previously developed criteria which assumed that in particle collisions their energies are concentrated not in their own kinetic energy but in the energy of the interaction. Thus, such interactions in some sense may be considered as strong interactions. This is a supplement to the author's article in Uspekhi Fiz. Nauk 61, 137(1957). (To be translated. The translation will be announced in NSA, when available.) (R.V.J.)

Tritium and Tritium Compounds

1801

HYPERFINE STRUCTURE OF TRITIUM IN THE GROUND STATE. A. G. Prodell and P. Kusch (Columbia Univ., New York). Phys. Rev. 106, 87-9(1957) Aug. 1.

The hyperfine splitting of tritium in the $1\,^2S_{1/2}$ state was measured by the atomic beam method. It was found that $\Delta\nu(T) = 1516.70170(7) \times 10^6\ sec^{-1}$, where the number in parentheses indicates the uncertainty in the last quoted figure. Within the precision of the presently available value of the ratio of the magnetic moment of the triton and the proton, there is no experimental evidence of a hyperfine structure anomaly between tritium and hydrogen. (auth)

Uranium and Uranium Compounds

1802 ANL-5752

Argonne National Lab., Lemont, Ill.

A STUDY OF MECHANICAL-ELECTROLYTIC POLISHING ON URANIUM METALLOGRAPHIC SPECIMENS. Floyd L. Brown. Jan. 1957. 19p. Contract W-31-109-Eng-38. $0.75(OTS).

Proposed techniques for "hot" metallographic preparation are described. The following data from experiments on saw cutting, hand grinding, and electrolytic polishing have been obtained: radioactive contamination from saw cutting and grinding; depths of scratches and cold worked metal from saw cutting and grinding; metal removal rates for various grades of emery grinding papers; metal removal rates for electropolishing; optimum sequence for specimen grinding on emery papers; and time requirements for satisfactory electrolytic polishing of saw cut, rough ground, and fine ground uranium specimens. It has been shown that an efficient and effective procedure for preparation of saw cut uranium is the removal of about three-fourths of the cold worked layer with grade number 2 paper, followed by grades 3/0 and 4/0. The remaining fine scratches and thin layer of cold worked metal were removed by prolonged electropolishing in phosphoric acid-ethylene glycol-ethyl alcohol solution. (auth)

1803 HW-51364

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR SAFETY IN PROCESSING URANIUM SOLUTIONS OF ALL ENRICHMENTS. N. Ketzlach. July 15, 1957. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A set of relatively simple formulas has been presented to calculate the critical parameters for homogeneous solutions of uranium of all enrichments in water. Comparison of calculated values has been made with experimental ones where available. Rules for the use of the calculated data have also been presented. (auth)

1804 RDB(S)/TM-3271

Gt. Brit. Springfields Works, Springfields, Lance, England.

THE CONTROL OF GRAIN SIZE IN CAST URANIUM BARS BY HEAT TREATMENT. W. A. Pollock. Dec. 17, 1953. 12p.

The coarse macro-structure of cast U is refined by quenching from temperature above the α-β change point. The conditions necessary for refinement were found to be not critical and are discussed in detail. (auth)

1805 RDB(W)/TN-78

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

A COMPARISON OF THE THERMAL CONDUCTIVITY OF IRRADIATED AND UNIRRADIATED URANIUM. J. C. Bates. July 1953. 13p.

Results indicate that there is no change greater than 5% (the experimental variation of the results) in the thermal conductivity of cast U which has received an irradiation of up to 300 Mwd/t. Experiments were carried out on U from two production cartridges which had received an irradiation in the Windscale piles of approximately 190 Mwd/t and 300 Mwd/t, at estimated central metal temperatures of 300 and 220°C, respectively. (auth)

PATENTS

Chemistry

1806

EXTRACTION OF URANIUM FROM ORE. E. Napier and D. Pearson (to U. K. Atomic Energy Authority). British Patent 774,371. Nuclear Eng. 2, 452(1957) Oct.

A U concentrate is prepared by leaching the ore with an aqueous alkali metal carbonate (sodium carbonate) solution (pH 11.8) containing a dissolved persulfate salt. The resulting solution is separated from undissolved matter, and the concentrate then recovered from the solution by adding a water-soluble alkali hydroxide, to precipitate the U as diuranate. Alternatively, an anion-exchange resin may be employed with elution of the adsorbate using an aqueous salt solution. (auth)

1807

RECOVERY OF MINERAL VALUES. R. E. Stedman and K. Arkless (to I.C.I., Ltd.). British Patent 775,119. Nuclear Eng. 2, 452(1957) Oct.

Uranium values are recovered from phosphatic minerals (e.g., rock phosphates) in which the U is present in the hexavalent state by subjecting them to an extraction treatment in an aqueous medium with a carbonate or bicarbonate of an alkali metal or of ammonium. The phosphate ion is precipitated by treatment with a cation, the liquor is separated from the insoluble phosphate thus produced and subjected to a further treatment by known means for the recovery of the U values. (auth)

1808

ION EXCHANGE PROCESSES. M. G. M. Atmore and R. R. Porter (to Transvaal and Orange Free State Chamber of Mines, Calcined Products, Pty., Ltd., (South Africa)). British Patent 775,529. Nuclear Eng. 2, 452(1957) Oct.

A process for the recovery of U in which relatively expensive ions are conserved for eluting purposes. The process is a three-stage process. In the first stage the ion exchange material does not carry the eluting ion. The second stage consists in the normal eluting step, which if followed by a third stage, i.e., a further eluting step in which the original eluting ion is displaced by the exchange ion. The exchange ion is conveniently the sulfate ion, the eluting ion, and the nitrate ion. The effluent recovered from the eluting ion recovery step may be concentrated and re-used for eluting purposes but it is preferred, after adsorption of the selected ion and before elution proper, to contact the ion exchange material with the recovered effluent so as to readsorb the eluting ion without displacement of the selected ion. When saturating the ion exchange material with the eluting ion, care is taken that the effluent from the saturation step does not contain an appreciably higher concentration of the selected ion than the original pregnant solution. In the recovery of U from a U-bearing solution the selected ion is the uranyl sulfate complex ion. (auth)

1809

REDUCTION OF METAL CHLORIDES. (to St. Joseph Lead Co. (U.S.A.)). British Patent 776,124. Nuclear Eng. 2, 452(1957) Oct.

Reduction of chlorides of titanium and zirconium using a steam of molten magnesium chloride in continuous circulation forming an upward and a downward current between an upper and a lower body of the chloride is reported. Molten magnesium and titanium tetrachloride or zirconium tetrachloride are introduced in certain proportions into the lower portion of the upwardly inclined current. From the lower body a suspension of titanium or zirconium in magnesium chloride is withdrawn. (auth)

1810

CLEANSING PREPARATIONS FOR USE AGAINST RADIOACTIVE CONTAMINATION. E. W. Jackson (to National Research Development Corp.). British Patent 776,148. Nuclear Eng. 2, 452(1957) Oct.

An alkali-free or superfatted soap or a synthetic detergent, a chelating agent forming water-soluble complexes with radioactive ions, and a water-insoluble electrically active powder of high electric interfacial potential opposite in sign to that of the ionic charge of the elements of contamination are reported. A preparation for cleansing from fission product contamination may be composed of soap chips (100 parts), dodecyl benzene sodium sulfonate (10 parts), wood flour (7 parts), ammonium citrate (10 parts), citric acid (sufficient to neutralize any gross alkalinity). The mixture is thoroughly milled, converted to plodded bars and tableted. In hospitals, universities, industrial concerns employing radioisotopes, ferric oxide or silica should be used as the insoluble powder. (auth)

Engineering

1811

HEAT EXCHANGE APPARATUS PARTICULARLY FOR VAPOUR GENERATION. (to Babcock and Wilcox Co. (U.S.A.)). British Patent 775,156. Nuclear Eng. 2, 452 (1957) Oct.

The apparatus is especially designed for service with high temperature and pressure corrosive heating fluid and rapid changes in temperature during operation and must be maintained uncontaminated by fluid leakage or products of corrosion. The material must be capable of withstanding the thermal stresses due to differential expansion of a tube bank and enclosing shell. The shell and the tubes within the shell are given a U-shaped configuration to present a uniform cross section throughout the length of the heat exchanger, which coupled with a series of uniformly spaced down-comer and riser connections provides a single hot fluid pass and cool fluid single pass heat exchanger of maximum effectiveness, mechanical integrity and minimum space requirements. The shell and the tube sheets are preferably constructed of high-tensile strength carbon steel. Austenitic stainless steel cladding is used to cover the interior surfaces of the hemispherical heads and the faces of the tube sheets. The U-shaped tubes are also of austenitic-stainless steel. The heating fluid may be pressurized water of 550 to 650°F (of 1,500 to 4,500 p.s.i.). (auth)

Mineralogy, Metallurgy, and Ceramics

1812

ELECTRO-DEPOSITION OF TITANIUM, ZIRCONIUM, HAFNIUM, TANTALUM, VANADIUM, NIOBIUM, CHROMIUM, MOLYBDENUM AND TUNGSTEN. (to Horizons Titanium Corp. (U.S.A.)). British Patent 775,585. Nuclear Eng. 2, 452(1957) Oct.

The cladding of metal bodies with corrosion-resistant metals by electrolysis in a fused salt bath is reported, as often structural conditions can be completely satisfied if only the surface is corrosion-resistant. It has been found that a metal body or support may be clad with, e.g., Ti or Zr at considerably lower temperatures by supplying the corrosion-resistant metal component of the fused salt bath in the form of its alkali metal double fluoride and by incorporating 0.25% to 10% of water (by weight). (auth)

1813

HIGH STRENGTH CORROSION-RESISTANT BODIES AND PRODUCTION THEREOF. (to American Electro Metal Corp. (U.S.A.)). British Patent 775,993. Nuclear Eng. 2, 452(1957) Oct.

It has been found that zirconium boride powder particles which are free from impurities can be used to form a shaped cemented body of high strength and corrosion resistance at high temperatures of 1,400 to 2,700°C. The body consists of at least 93% zirconium diboride (ZrB_2). The particles are bonded by a boron substance containing carbon in solid solution based on the discovery that if carbon stabilized boron is combined in proportion of 2 to 7% with zirconium diboride a cemented hard body can be formed by compacting and heating at temperatures considerably below the melting temperature of the zirconium diboride. The material has been found of value as pump components for pumping molten aluminum or liquid gallium (as heat transfer media). (auth)

Physics

1814

GAS-COOLED ATOMIC REACTOR EQUIPMENT. (to Allmanna Svenska Electriska AB (Sweden)). British Patent 775,602. Nuclear Eng. 2, 452(1957) Oct.

Gases, preferably CO_2 compressed to about 60 atm., are especially suitable as heat transmission media. There are, however, some constructional problems connected with the use of highly compressed gases. The reactor consists of an Al tank filled with heavy water and surrounded by a graphite mantle as neutron reflector. Fuel rods of U or Th are inserted in the tank and are, e.g., hollow or H-shaped so that highly compressed gas can flow along these rods for cooling and heat transmission. Distance members of Zr or Be are inserted between the rods. They are surrounded by tubes of a material similar to that of the distance members. The tubes are fixed in a gas distributing and a gas collecting vessel with numerous inlet and outlet pipes. In order to reduce the pumping power required for the gas at such high pressure, the collecting vessel is divided into a number of ring-shaped chambers. The pipes are connected to individual pump systems and the arrangement permits equalizing of the temperature by throttling the cross-section of the flow of gas. (auth)

1815

APPARATUS FOR DETECTING RADIOACTIVITY. (to Etat Francaise (France)). British Patent 776,576. Nuclear Eng. 2, 452(1957) Oct.

An apparatus is described which includes an ionization chamber (or other detector) with at least two electrodes maintained at a potential difference which varies under the effect of radioactivity. The variations in the intensity of the radioactive radiation produce corresponding variations in the current at the output of the detector and this current

is independent of the voltage of the source of the current, provided it is above a minimum or critical value. These currents are very small. For a cylindrical ionization chamber of a volume of 1cc the saturation current corresponding to an intensity of gamma rays equal to 1 roentgen per hour averages 10^{-10} amp. Based on this fact, a high insulation capacitor is used as source of potential which is periodically charged, e.g. by a magneto or dynamo actuated by an operator, by an electro-magnetic impulse system, or the like. If the voltage is then measured by an apparatus consuming practically no current, e.g. a quadrant electrometer, the capacitor can be kept charged for a long time (one hour or more) and can be made of light weight and small dimensions. (auth)

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